A Framework for Simulation Support of the MDMP

by

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Simulation used for tactical Army training is well understood. The proposed merging of C4I and simulation systems for planning is not as clearly defined. Solving the problem requires a theoretical model based on doctrine. Army doctrine defines the current MDMP process and products. Therefore, it may serve as the basis for criteria to define simulation support in the MDMP. But doctrine is not easily converted into object-oriented requirements for coding. Furthermore, simulation's inherent flexibility, interoperability, entity behaviors, recording, and decision support capabilities require additions to the doctrine. This research attempts to answer the question, "What are the functional criteria necessary for a war-gaming simulation to support the MDMP during tactical operations?" It proposes a criteria framework for simulation support of the MDMP. The framework is derived from doctrine and previous studies. Subject matter experts give feedback on the framework through a survey. The resulting product may be used to define the requirements for a tactical planning simulation to support the current MDMP.

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LIST OF ABBREVIATIONS

AAR – After Action Review

ABCS – Army Battle Command System

AMSO – Army Modeling and Simulation Office

AR – Army Regulation

ARTEP – Army Training and Evaluation Program

BCBL – Battle Command Battle Laboratory

C4I – Command, Control, Communications, Computers, and Intelligence

C4ISR - Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance

CADD – Combined Arms Doctrine Directorate, Ft. Leavenworth, KS

CALL – Center for Army Lessons Learned

CGSC – Command and General Staff College

COA – Course of Action

COAA – Course of Action Analysis [simulation program]

CPOF – Command Post of the Future

CTC – Combat Training Center

DARPA – Defense Advanced Research Projects Agency

DOD – Department of Defense

FBCB2 – Force XXI Battle Command Brigade and Below

FM – Field Manual

FSO – Fire Support Officer

GUI – Graphic User Interface

HQDA – Headquarters, Department of the Army

ID – Infantry Division

IPB – Intelligence Preparation of the Battlefield

ITOC – Information Technology and Operations Center, West Point, NY

JMACE – Joint Military Art of Command Environment

MDMP – Military Decision-Making Process

METT-TC – Mission, Enemy, Terrain, Troops, Time, and Civilian

MOE – Measures of Effectiveness

MTP – Mission Training Plan

MTWS – Marine Air-Ground Task Force Tactical Warfare Simulator

NIMA – National Imagery and Mapping Agency

NSC – National Simulation Center

NVG – Night Vision Goggles

OPORD – Operations Order

ORD – Operational Requirements Document

OPTEMPO – Operational Tempo

OTB – OneSAF Test Bed Baseline

PW’98 – Prairie Warrior 1998

S1 – Personnel Officer

S2 – Intelligence Officer

S3 – Operations Officer

S4 – Logistics Officer

SA – Situational Awareness

SASO – Stability and Support Operations

SITTEMP – Situational Template

SME – Subject Matter Experts

STRICOM – Simulation, Training, and Instrumentation Command

TTPs – Tactics, Techniques, and Procedures

TRAC – TRADOC Analysis Center

TRADOC – U.S. Army Training and Doctrine Command

UFD – User Functional Description

USMA – United States Military Academy, West Point, NY

WARSIM – Warfighters’ Simulation

XO – Executive Officer

CHAPTER 1: THE MDMP, SIMULATION, AND WAR-GAMING

1.1 The Military Decision-Making Process

U.S. Army staffs rely on the Military Decision-Making Process (MDMP) to plan operations. Field Manual (FM) 101-5[1], *Staff Organization and Operations*, defines the MDMP as a, "Tool that assists the commander and staff in developing estimates and a plan" (FM 101-5, 1997, 5-1). Service schools instruct all Army officers on use of the MDMP. Unit headquarters use the MDMP to plan operations that synchronize friendly forces and effects at the decisive point to accomplish the mission. Organizational staffs follow the process to estimate the situation, develop and analyze courses of action (COA), and disseminate information as an Operations Order (OPORD). The MDMP is currently being revised for use in a digital command and control environment.

In a combat environment, every tactical plan must be balanced against the available military intelligence used to develop and choose the planned COA. The staff and commander must devise the best plan for the proposed enemy

[1] FM 101-5 has been renamed FM 5-0.

Situational Template (SITTEMP) and contingencies for anything the enemy is capable of doing. If little is known about the enemy, the developed plan must be weighed against possible differences in the opposing force's composition, disposition, and strength. In this case, the commander maintains flexibility through contingency planning and decision analysis. Contingency planning requires a significant amount of time during the process.

The MDMP is composed of seven steps. These steps are: (1) Receive the mission, (2) Mission Analysis, (3) COA Development, (4) COA Analysis, (5) COA Comparison, (6) COA Approval, and (7) Orders Production (FM 101-5, 1997, 5-2). FM 101-5 does not specify a time standard for an organizational staff to complete the MDMP. However, the manual does give considerations for planning in a time-constrained environment. Furthermore, the Center for Army Lessons Learned (CALL) published guidelines for available time allocation in various planning situations (See Appendix B).

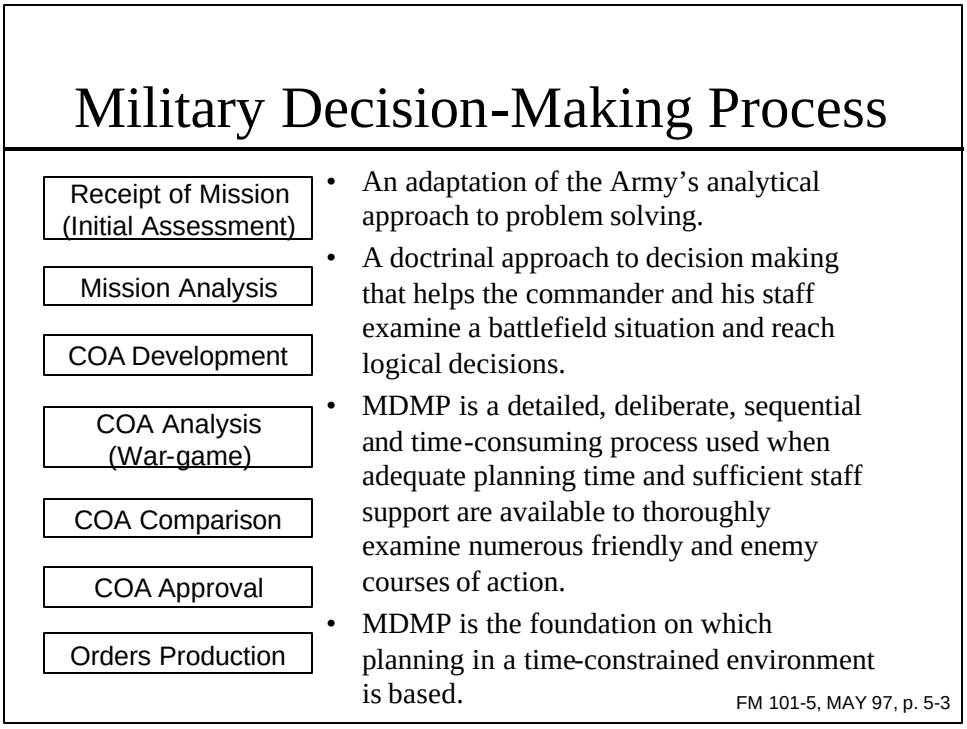

Figure 1.1, The MDMP

1.2 War-Gaming and Visualization

The staff develops COAs based on standards described in FM 101-5. To evaluate the potential effectiveness of the developed COAs, organizational staffs use course of action analysis, also known as war-gaming. FM 101-5 defines war-gaming as, "A disciplined process, with rules and steps, that attempts to visualize the flow of a battle [and] relies heavily on a doctrinal foundation, tactical judgment, and experience" (FM 101-5, 1997, 5-16). Based on

the empirical evidence of successful tactical operations in recent history, the current U.S. Army method of war-gaming is excellent for synchronizing operations[2]. War-gaming is a powerful tool for examining the relationships between complex and dynamic opposing forces in a short amount of time. War-gaming facilitates a holistic approach to modeling the effects of Mission, Enemy, Terrain, Troops, Time, and Civilian (METT-TC) factors in the operation. The use of an action-reaction-counteraction paradigm allows the staff to predict potential contingencies, their outcomes, and decisions. According to FM 101-5, war-gaming also allows the staff to minimize casualties, maximize combat power, maintain the initiative, determine the most flexible course of action, and have as near identical vision of the battle as possible (FM 101-5, 1997, 5-16).

Common picture, or visualization, ensures soldiers, commanders, and staffs understand the plan and their role in it. "Battlefield visualization [is] a critical component of battle command...Soldiers will be empowered for independent action because of enhanced situational

[2] As defined in FM 101-5 and taught in U.S. Army Service Schools.

awareness, digital control, and a common view of what needs to be done" (TRADOC PAM 525-70, 1995, 2). In his 1996 monograph, MAJ John E. Frame succinctly described the critical link between war-gaming and visualization. Frame said, "If commanders and staffs are to integrate or synchronize the detailed decisions and activities of the complex battlefield then they must have the same image of battle. This image must be constructed during war-gaming" (Frame, 1996, 38). Frame also suggests that war-gaming is composed of mental and physical components—both developed throughout the MDMP and shared as a mental model (Frame, 1996, 3).

Battle Command Battle Lab (BCBL) pamphlet 2.1 describes visualization as, "The act of forming a mental picture of the current and future state, based on a higher commander's intent, available information, and intuition" (Frame, 1996, 11). Ideally, all soldiers assigned to a unit have a clear picture of their part in the operation and how it supports the mission and main effort. This supporting, integral concept of the military planning process is extremely important to synchronizing operations.

Understanding and communicating this visualization of the time-space relationships and subordinate tasks of an operation are the essential intended functions of the MDMP. These functions are established through war-gaming. Successful achievement of a common picture of visualization through COA analysis, plan dissemination, and rehearsals is critical to mission accomplishment.

1.3 Problems Inherent in War-gaming Today

The current method of implementing war-gaming does not aid in the primary function of the MDMP – understanding and communication of the tactical plan (Frame, 1996, 40).

1.3.1 Understanding the Visualization

War-gaming implementation mistakes usually occur when the staff is under time pressure. CALL identified problems with the current COA analysis execution at the Combat Training Centers (CTC) (CALL, "CTC Publications List," Available at: http://call.army.mil). These problems usually deal with training staffs to war-game correctly and cohesively. Other lessons learned point to faulty MDMP

execution procedures and instructions as outlined in FM 101-5.

At the tactical level of maneuver warfare, planning time is typically short. Lack of time and the situation usually conflict with the tactical commander's goal of achieving the best plan before beginning the mission. The MDMP requires that the Intelligence Officer (S2) create two enemy Situational Templates (SITTEMPs)-the opposing force's most likely and most dangerous courses of action. FM 101-5 specifies that the Operations Officer (S3) develop more than one COA to analyze.

Since doctrine requires that each COA must be (hastily) war-gamed against each SITTEMP, the time burden may restrict staffs to incomplete planning. Staffs often overcome time constraints by not properly war-gaming each COA against each SITTEMP. CTC lessons learned detail the problems infantry and armor battalion and brigade staffs usually encounter during war-gaming. CALL bulletins attribute high casualty rates directly to these problems. Staffs simply do not have sufficient time to war-game for all likely contingencies. Thus, time constraints detract

from a full understanding of possible contingency operations. Furthermore, organizations cannot fully visualize the battlefield without analyzing the most likely contingencies.

1.3.2 Communicating the Visualization

While commanders seek (and often implement) the most flexible plan, the current method of COA analysis does not allow flexibility in changing or communicating it. When COA analysis is complete, the paper products (decision support template, synchronization matrix, fire support overlay, etc.) are all that remain. Subordinate commanders typically see these paper products and a travelogue summary of the scheme of maneuver during the OPORD briefing. Through careful study, communication, and rehearsals, commanders achieve common visualization before the plan is executed. Participants have the end products of the physical COA analysis to refer to.

When the plan is changed due to updated intelligence or other METT-TC factors, this common visualization is degraded. Furthermore, if changes to the situation occur,

there is no easy way to conduct a complete staff analysis and adjust the COA. In a tactical setting, the commander or staff must mentally war-game changes and adjust the plan accordingly. He must then communicate it as well as possible with his subordinates through a supporting Command, Control, Computers, Communications, and Intelligence (C4I) system.

1.4 Simulation for Tactical Planning

Typically, constructive simulation in the Army is used for training at the tactical level. For training exercises, battalion and brigade commanders and their staffs execute the MDMP and then implement selected COAs on a simulation such as JANUS. This is an effective way to train staffs. It is also valuable for demonstrating concepts to students. Unfortunately, it has not been demonstrated as a means of implementing war-gaming in tactical operations while using existing C4I systems. Strategic and operational level staffs sometimes have the ability to use simulation for mission planning. The longer distances and planning timelines of higher-level missions

allow more detailed COA analysis using simulations. Tactical planners currently do not have this ability.

The Army's currently proposed constructive simulation for tactical training, OneSAF, addresses the need for a COA analysis tool to support the MDMP during tactical operations. Unfortunately, the OneSAF Operational Requirements Document (ORD) does not specify many of the requirements a COA simulation will need (OneSAF ORD, 2000, 2-3). OneSAF is designed to simulate brigade and below operations for stand-alone use or aggregated into higher-level simulations. Since OneSAF is meant to support other simulation and C4I systems, interoperability issues including High Level Architecture (HLA) compliance have been carefully thought out. However, the OneSAF ORD makes no mention of supporting the C4I system FBCB2—where a simulation supporting war-gaming need exists (FBCB2 UFD, 1999, 2). Force XXI Battle Command Brigade and Below (FBCB2) is the revolutionary C4I system for brigade and below units.

1.5 Existing Potential MDMP COA Analysis Simulations

Several current projects seek to enable COA analysis for the MDMP. Other projects try to improve constructive simulation in the Army. Force XXI initiatives are currently dedicating significant resources to achieving information dominance on the modern battlefield. OneSAF and FBCB2 seek to join simulation and C4I, respectively.

1.5.1 OneSAF

OneSAF improves on existing tactical-level constructive simulation (ModSAF, JANUS). Therefore, its functional requirements are mature and well known through years of experience. However, OneSAF was designed to be a training device to model brigade and below units (OneSAF ORD, 2000, 2). If it can be adjusted to provide COA analysis in support of FBCB2 is a question of meeting operational and doctrinal criteria. While the FBCB2 ORD requires quick execution and setup time for a simulation to support the MDMP, these criteria are not a priority for

OneSAF. OneSAF is also not designed to support FBCB2[3]. Furthermore, the OneSAF ORD reveals that OneSAF will not be able to model Military Operations on Urban Terrain (MOUT) realistically due to its lack of consideration for planning considerations given in FM 90-10-1, *An Infantryman's Guide to Combat in Built-Up Areas*.

1.5.2 FBCB2

FBCB2 is designed to increase situational awareness, reporting, and bookkeeping on the battlefield (HQDA FBCB2 UFD, 1999, 2). FBCB2 incorporates an extensive User Functional Description (UFD). The UFD is requirements-based and thoroughly covers the spectrum of military operations. It is centered on the 20 maneuver battlefield functions. For example, battlefield function # 6 addresses the "Planning of Combat Operations." The FBCB2 UFD addresses functionality issues specifically involving the GUI, interoperability, and data storage / transfer. It does not consider entity behavioral modeling, scenario run-

[3] OneSAF ORD does not require a minimum setup time and does not require support for FBCB2.

time, and other operational and functional criteria of a simulation supporting the MDMP (FBCB2 UFD, 1999, 82).

Army leaders recognize the power of simulation for war-gaming. COL K. Steven Collier, director of the Army Modeling and Simulation Office (AMSO) recently recommended, “Automated decision-making systems to assist commanders and their staffs during the planning, preparation, and execution phases of combat operations” (Collier, 1998, 5). COL Collier also states that such tools would not replace the commander but make his information processing abilities much better. COL Collier asserts that such a tool would be too slow if designed to produce the optimal solution (Collier, 1998, 6).

The currently implied merging of technology and doctrine for COA analysis during operations may require that the MDMP be updated also. The repeatability and versatility of simulation may greatly enhance contingency analysis and decision analysis in tactical planning. FM 101-5 is currently being updated for digital execution of the MDMP (Domitrovich, 2000). C4I efforts such as FBCB2 focus on situational awareness, logistical bookkeeping, and

fires synchronization (FBCB2 UFD, 1999, 2). While the FBCB2 UFD addresses the need for a COA development and analysis tool, it simply summarizes FM 101-5 and does not address functional or doctrinal requirements of the system beyond the Graphic User Interface (GUI).

1.6 Developing a Tactical War-gaming Simulation Tool

Doctrine dictates how units fight. It is the basis for all operations. Army staff officers are not typically model experts in the simulations they use for training. Likewise, war-gaming is not a precise scientific analysis of opposing forces. Jim Dunnigan eloquently defined the differences between simulation, war-gaming, and modeling in his book, *The Wargames Handbook*.

> The three terms are commonly (and incorrectly) used interchangeably, but each term means quite something different to the military wargamer. Wargames are usually simpler than models and simulations because, as the names imply, a wargame is something of a competitive game that is played while a model is a more detailed representation of a specific military event. A model duplicates a function in great detail and exactitude. A simulation is a model, or collection of models, that can be more easily manipulated to test "what if" questions.

> A simulation is a model that can move in many different directions. A wargame is a playable simulation."[4]

Because war-gaming encompasses complex models and interactions, user requirements and doctrine must be engineered into them prior to development. Therefore, functional and doctrinal criteria form the basis of an adequate simulation of the military environment.

Proposed simulation applications addressing the need for a COA analysis simulation attempt to meet the needs of the tactical user in an operational environment. JMACE (Joint Military Art of Command Environment) is a National Simulation Center (NSC) simulation product designed for war-gaming and collaborative planning. This system will be used to evaluate concepts for inclusion in currently developing and proposed C4I projects.

Dunnigan states that the first step in war-game development is to know what the user wants (Dunnigan, 1992, 1117). This is known as determining the functional requirements in systems analysis. In considering the user

[4] From The Wargames Handbook (Wargames at War chapter) paragraph 6, by James F. Dunnigan, Available at http://members.aol.com/jfdunnigan/private/index.htm Copyright 1997 by James F. Dunnigan. Reprinted with Permission.

first it is necessary to define the functional criteria the system must meet to support him. These criteria may be extracted from existing requirements documents but must be qualified with specific Measures Of Effectiveness (MOE). Doctrine, experience, and proven heuristics determine the MOE. Functional criteria and their MOE can then be used to establish the object methods in the design of a simulation to support COA analysis.

The functional user and doctrinal criteria will determine the successful implementation of a simulation in support of war-gaming. Unfortunately, these criteria have never been adequately determined. The object diagrams for projects such as JMACE may give insight on functionality but do not offer a complete solution. Hence, the question, “What are the functional criteria necessary for a war-gaming simulation to support the MDMP during tactical operations?”

CHAPTER 2: DEFINING THE FRAMEWORK

2.1 System Development

The current Army acquisition process is based on performance specifications. Army Regulation (AR) 70-1, *Army Acquisition Policy*, considers cost, end requirements, reliability, and reusability as the major factors in contract approval. Furthermore, the Army acquisition system attempts to leverage existing civilian applications and technologies for new equipment as opposed to creating (and paying for) new developments. AR 70-1 requires program managers to, "Be customer focused and provide the user with the best, most cost-effective system or capability" (AR 70-1, 1998, 3). Unfortunately, the doctrinal impacts of new equipment may not be considered for many years after complete fielding of the items. For example, the Army has fielded AN/PAQ-4 laser aiming devices and Night Vision Goggles to units since 1995 but has not developed a standard for night qualification with them[5].

This inconsistent method of ensuring new equipment is doctrinally integrated into the Army necessitates a

[5] FM 23-9 most recent version is 03 JUL 89

detailed, fundamental approach to requirements analysis. Therefore, this research is compelled to propose a methodology for decomposing COA analysis doctrine during the MDMP into functional criteria. The functional criteria can then serve as the basis for an object-oriented analysis. This methodology necessitates updating (or at least examining) the MDMP COA analysis doctrine concurrently with system development. Concurrent development is the key approach for getting operational equipment correctly fielded in the Army. A standardized approach ensures the ideas used to develop the system comply with traditional practices and historically successful techniques. Doctrinal analysis should be considered as the basis of all requirements for operational Army systems. The issue is not simply, “How can we best leverage a new technology?”

2.2 Existing and Previous Approaches

Several Department of Defense (DOD) simulation agencies have experimented with COA analysis simulations. Bohman (1999) as well as Barone and Roberts (1998) found

that no currently existing simulations are capable of supporting COA analysis.

One limitation is in terrain representation. Addressing that limitation in part, the National Imagery and Mapping Agency (NIMA) developed a terrain database easily adaptable to many different formats. "VMap-2™ [or Vector Map Level 2] is intended for use by tactical planners and generally fills the role of geographic information found on paper maps at scales of 1:50,000 and 1:100,000" ("NIMA, Available at: http://164.214.2.54/mel/vmap2inf.html). While VMAP-2™ has some limitations, it may be adaptable and flexible enough for simulation.

Another possible solution to the terrain problem may arise from commercial computer war-gaming. Talonsoft's *The Operational Art of War Volume II: Modern Battles* has a scenario editor built into the game. This scenario editor allows users to build terrain from "templates" which unit entities recognize and react to as they fight the battle. Perhaps these ideas can be leveraged for use in the military simulation environment.

The Defense Advanced Research Projects Agency (DARPA) is currently developing the Command Post of the Future (CPOF) project. Through the CPOF, DARPA seeks to develop the concepts necessary to integrate C4I into the battlefield. While CPOF is aimed at brigade through corps units, program findings may apply to tactical planning. The CPOF analysis methodology is typical of a prototype approach to developing a COA analysis tool.

Prairie Warrior, 1998 (PW'98) used a focus group of the division staff from the 4th Infantry Division (ID) to test Command, Control, Communications, Computers, Surveillance, and Reconnaissance (C4ISR) concepts with Command and General Staff College (CGSC) students. The exercise focused on Situational Awareness (SA). However, planning and functionality concerns were part of the lessons learned. Although PW'98 was a corps level exercise, it captured ideas that may be applied to a tactical system and offers insight into functionality concerns. Many of the lessons learned focused on exercise conduct and control and collaborative planning techniques. The participants also recommended several functional

criteria including attention-focusing devices for planning routes. The 4th ID staff was concerned that they lost the "feel" of the terrain because planning was digitized. They also stated a need for resource allocation and tracking tools – particularly in the intelligence area. Furthermore, the participants expressed the need for an electronic sand table with photo-realistic terrain mapping to provide a 3d "stealth" view of the battle for terrain analysis and better visualization (DARPA, Available at:http://www-code44.spawar.navy.mil/cpof/pwfg.html).

Visicom used the Marine Air-Ground Task Force Tactical Warfare Simulator (MTWS) to conduct a prototype COA analysis simulation in the form of a proof-of-concept experiment. Using the MTWS, Garrabrants and Blais (1999) found that simulation used for COA analysis required rapid scenario design and execution, aggregation of entities, and MOE to evaluate the course of action. This study recommended using a simulation for mission analysis, briefings, COA analysis and comparison, mission rehearsal, and post-operational analysis (Blais and Garrabrants, 1999, 850-853).

MITRE and CECOM made SimLink to test COA development and analysis. Barone and Roberts (1998) found simulation supporting the COA analysis phase of the MDMP requires faster than real-time processing capabilities. They also discovered that military planners typically develop and analyze the COA at the same time. This led them to summarize that flexibility is the key requirement for a simulation supporting the MDMP. Barone and Roberts proposed that no current simulation was capable of handling such a problem at that time. The most difficult problem they perceived was the failure of simulations to replay and edit scenarios quickly and easily. Barone and Roberts suggested that simulation could be used for plan validation after the manual war game was complete. They also theorized that a COA analysis simulation could be used as a real-time plan monitoring execution tool (Barone and Roberts, Available at: http://siso.sc.ist.ucf.edu/siw/98fall/ViewPaper_98F.htm, 7).

DARPA's Course of Action Analysis (COAA) program was another prototype system. The U.S. Army Simulation,

Training, and Instrumentation Command (STRICOM) developed COAA to test the operational / tactical concepts of a war-gaming simulation. COAA is a constraint-based, object-oriented simulation. The program focused on a war-gaming tool that provided for (1) hasty or deliberate, division-level planning, (2) increased MDMP execution speed, (3) resilient, simple planning, (4) a map-centric paradigm, (5) a collaborative analysis environment, (6) risk and sensitivity analysis of the COA, and (7) conventional war-gaming analysis using the action-reaction-counteraction process of [FM 5-0] (SAIC, 1999, 42-43). Its rapidly prototyped development was limited in scope to a proof-of-concept display. Therefore, it suffered from the lack of ability to easily vary the terrain for different operations. COAA provided functional lessons learned concentrating mainly on the graphic user interface (GUI). Some of these results recognize concepts that are critical to war-gaming on a computer.

COAA examined the trade-off between simulation run time and speed of war-gaming. It sacrificed valid combat modeling algorithms for run-time speed. This is an

important consideration that must be carefully designed into any COA analysis simulation. COAA also confirmed SimLink's finding that COA development and analysis are done simultaneously[6]. Other methods to quantify simulation functionality requirements are "common sense" based. They often attempt to define a concept or illustrate a point. Each of these efforts' requirements for simulation in support of military planning show a common ground for advanced concept design.

For example, Bohman (1999) proposed a war-gaming simulation predicated on the functional criteria that it (1) can be run in one to three hours, (2) is easy to use, (3) is PC-based, (4) requires no specially trained support staff, and (5) can quickly and easily implement new terrain databases (Bohman, 1999, 23).

Surdu, Haines, and Pooch (1999) suggested that an "operationally focused simulation" (Surdu, Haines, and Pooch, 1999, 1-2) must be (1) PC-based, (2) executable on low-cost systems and open-source, (3) capable of real and above real-time execution, (4) able to answer queries from

[6] COAA did not have a COA development tool

external agents, (5) network capable, and (6) capable of aggregating entities. Their OPSIM project demonstrated important capabilities necessary for C4I developments. However, the scope of the project did not include behavioral modeling, which is necessary for a COA analysis simulation.

These concepts present interesting and valid concerns but do not delve deeply enough into critical functional and doctrinal criteria of a COA analysis simulation tool.

2.3 Leveraging Simulation to Improve the MDMP

The previous approaches show that FMs and MTPs do not provide all necessary measures for a simulation to support the MDMP. Remembering the main research premise that the significant benefit MDMP simulation support is for increased visualization through better analysis of COAs and contingencies helps to put the concept in perspective. In this way, the MDMP is a decision support system. The simulation tool must support each aspect/phase of the MDMP to be useful. Research performed by Laudon and Laudon in 1996 found that decision support systems must be flexible

to accommodate complex organizations. Furthermore, decision support tools must have superior data collection and analysis abilities. Laudon and Laudon stated that these tools must support organizational and individual decision-making functions with emphasis on capabilities and limitations of the system (Laudon and Laudon, 1996, 131).

Given these facts, there are five simulation capabilities not supported by doctrine that require special attention and, most likely, debate when determining criteria for an MDMP support tool. These capabilities are (1) flexibility, (2) interoperability, (3) entity behaviors, (4) recording, and (5) decision support.

Simulation Strength	**Reference**
•Flexibility	OneSAF ORD, Barone and Roberts, Garrabrants and Blais, Laudon and Laudon, and Surdu
•Interoperability	Army Regulation 5-11, FBCB2, Surdu, and JMACE experiment
•Entity Behavior	OneSAF ORD
•Recording	OneSAF ORD, Laudon and Laudon
•Decision Support	FBCB2, COL Collier, Laudon and Laudon

Figure 2.1, Simulation Strengths

Flexibility primarily requires that the simulation is capable of analyzing a COA at much faster than real-time speed. Speed of simulation has no counterpart in today's manual MDMP. In fact, no doctrinal source indicates a time standard for planning execution. Guidelines developed by CALL in Appendix B give timelines for planning. While collaborative planning tools such as JMACE can run much faster than real time, briefing requires that the simulation speed be changeable as on a sliding scale. This criterion will greatly enhance contingency planning and decision point branch and sequel analysis. Flexibility also necessitates that the user can change the simulation at will. Staff members may need to manipulate simulation entities, characteristics, and/or conditions at any time during the simulation. Furthermore, incorporating multiple COAs with branches and contingencies in the same OPORD could allow better visualization of the entire operation.

AR 5-11, *Management of Army Models and Simulations*, requires that all simulations be interoperable. The simulation must be interoperable in the classic sense (with C4I systems) but must also support and provide networking

assistance to organizations. Due to battlefield distance, collaborative planning capabilities are paramount to quick and efficient mission planning. CGSC experiments with JMACE demonstrate the need for a collaborative planning tool to support the MDMP.

The FBCB2 UFD also requires collaborative planning capabilities. In today's manual MDMP, upon mission receipt the brigade staff gets the OPORD from the division including several graphic overlays and other products. The graphics are typically reproduced either by hand or by a large diazo copying device. A simulation must incorporate higher headquarters graphics in electronic format (FBCB2 UFD, 1999, 63). It must also be able to separate them by type, display and simulate any combination of them (run enemy SITTEMP, logistics, fire, maneuver, and air at the same time or lesser/more combinations), and allow their manipulation and saving in a separate file. Entities must understand graphic boundaries, and orient / behave similar to real units when interacting with the graphics. The FBCB2 UFD also stipulates that an electronic component of the MDMP should also be able to export or print graphics.

Automated entity behavior is the third benefit of using simulation to support the MDMP. Currently, in manual war-gaming, staff officers move paper icons on a map or terrain sketch to synchronize the battle. Deviation from anticipated movement rates as well as attrition are argued by the war-game players. Simulation entities can model actual unit behavior under varying conditions that may not currently be accounted for in the manual method. Entity behaviors are discussed in greater detail later in chapter three.

The fourth discrepancy between doctrine and simulation capabilities is recording. The OneSAF ORD stipulates that the simulation must include detailed logging and AAR capabilities. Simulation has the capability to note every detail of a course of action. A logging feature incorporating simulation events into a database would provide a military staff with an instant synchronization matrix for each course of action. This matrix is then easily queried and sorted according to time, location, unit, or event (casualty, artillery fire, contact, phase line crossing, supply deficiency, etc). The potential

impact of such a concept for battlefield synchronization is immense. For example, the logger may also record time-space factors such as speed and distance to target for entities and provide estimates for the S3 to adjust the fire plan (for time-on-target missions) in case of unforeseen contingencies. The logged database concept also provides the opportunity for a results role-up to aid in COA comparison. The staff and commander would still select the COA comparison criteria. The log could then automatically feed results of standardized objective criteria into another tool for ease of comparison. To this, the staff members would add subjective assessments of other criteria such as surprise.

The last advantage of simulation over the manual method is decision support. Laudon and Laudon found a decision support tool must, "[Have] multiple analytical and intuitive models for the evaluation of data and the ability to keep track of many alternatives and consequences" (Laudon and Laudon, 1996, 131). COL Collier presents the need for decision support aids embedded in simulation. The FBCB2 UFD also stipulates that it provide decision support

aids. Computers have the ability to analyze things that may be missed by humans. For example, simulation may detect an unused asset, potential fratricide, or the better allocation of resources (particularly logistic assets). Capabilities, requirements, and validation of decision aids embedded in a simulation are beyond the scope of this research. Decision support is not included in the attached criteria. It is a very complex issue that requires further study.

Simulation's inherent flexibility, interoperability, entity behavior, recording, and decision support capabilities will provide significant advantages over the current manual method. These five areas are the key criteria for subject matter experts to examine because they are not supported by doctrine.

2.4 Scope of Research

As discussed previously, many existing or proposed COA analysis simulations attempt but do not meet the user's needs for MDMP COA analysis. A careful analysis of all of them yields some of the functional criteria for the use of

a simulation in support of war-gaming. But, any simulation must support all phases of the MDMP (particularly COA development) and not just COA analysis. This conclusion can be drawn from Simlink's findings (confirmed by COAA) that COA development and analysis are done simultaneously (Barone and Roberts, Available at: http://siso.sc.ist.ucf.edu/siw/98fall/ViewPaper_98F.htm, 2). Doctrine must be incorporated into any criteria for a simulation to support the MDMP. A review of available literature raises a key question: How does one convert doctrine to requirements in an evolving area like MDMP COA analysis?

This research seeks to identify criteria and MOE for a simulation to support the MDMP at the tactical level. The MOE is adapted from FMs and other Army doctrine.

CHAPTER 3: FRAMEWORK DEVELOPMENT

3.1 Research Methodology

The major premise of this research is that simulation can support and enhance the current MDMP process through improved COA analysis. This research investigates the doctrinal and functional criteria necessary for creating a simulation to support COA analysis in the MDMP. The research proposes criteria based on a study of tactical doctrine. Specifically, Mission Training Plan (MTP) and FM standards provide the criteria and MOE necessary for a system development framework. Subject matter experts (SME) validate the framework of criteria and MOE through a survey.

3.2 Creating System Requirements from Doctrine

Among other things, FMs document tactical doctrine. Hundreds of FMs serve as the basis for all operations with specific FMs articulating U.S. Army doctrine on particular topics. Leaders use FMs with MTPS to ensure a highly trained unit. The Army uses MTPs for collective task evaluation. Units are evaluated on task standards using

MTPs during training exercises. While FMs illustrate Tactics, Techniques, and Procedures (TTPs), MTPs dictate the critical task steps and the task's sequenced standards. MTPs are designed for each unit type and size. The transformation of tactical doctrine into system criteria begins with the MTP.

Evaluation of MTPs provides the basis for a detailed task analysis used in establishing a criteria framework. MTPs give standards under varying conditions for successful task accomplishment. Expertise may enable linking the task standards to other sources including CTC lessons learned, CALL TTPs, and service school publications.

FMs provide the majority of MOE required for developing a simulation criteria framework for COA analysis. These measures must be specific enough for easy translation into technical specifications or object-oriented code. However, the measures must also be simple enough to make sense to the user. Detail promotes common understanding between the user and the developer. This understanding is critical when fielding new equipment to the soldiers it is intended to support.

This research is focused on adapting system criteria to existing doctrine. Doctrinal analysis, however, must be approached with the notion that new doctrinal ideas may be necessary to field a simulation COA analysis system. Therefore, field manuals may evolve as the new system is developed. For example, a simulation can rapidly replay a scenario to aid in briefing and contingency analysis. The current manual MDMP has no ability or requirement for rapid replay. Rapid prototyping allows feedback on ideas through user testing and may enable analysis and adopting of doctrinal changes as well as system changes. However, adding new tasks or ideas to FMs is beyond the scope of this thesis and will not be addressed here.

3.3 Methodology

For a simulation to support the MDMP, doctrinal analysis of FM 101-5 serves as the catalyst for developing the criteria. FM 101-5 details the seven-step MDMP process and the tasks a staff is required to perform to plan a mission. The actual collective tasks, conditions, and standards must be extracted from a Mission Training Plan,

specifically ARTEP 7-30-MTP, *Mission Training Plan for the Infantry Brigade Headquarters and Headquarters Company*.

The seven category baseline (steps of the MDMP) must be expanded and detailed by including the tasks of ARTEP 7-30-MTP. The MTP task of "Conduct Military Decision-Making Process" located in Appendix C provides an excellent one-source summary of the doctrine and steps of the MDMP and is also applicable to battalion planning. It serves as a GO/NO-GO checklist for evaluating the brigade staff's execution of operational planning. Other criteria are derived from the tasks and functions of the staff officers of the brigade.

The seven steps of the MDMP (Appendix A) given in FM 101-5, serve as the major functions required of a simulation to support military planning. The seven steps of the MDMP correspond to the first seven categories of the framework developed in this research (Appendix E). For a simulation to support the MDMP, it must be able to provide analysis assistance and timesaving functions during all of these steps.

Appendix A serves as the basic criteria to which measures supported by FMs can be added. In developing the framework, it is necessary to generalize often to allow for increased flexibility. For example, the framework suggests developers must incorporate all munitions types and their effects. However, this requirement does not stipulate how to model attrition or what current munitions types are available. In this way, the framework allows for technological improvement/ inclusion of future ammunition types and developer selection of the best appropriate model for attrition. Thus, the framework may serve to provide guidance for many years.

3.3.1 Assumptions

The following assumptions facilitate the framework development:

1. Development of a simulation supporting tactical planning begins with objective portions of the current MDMP. Simulation models for subjective functions and cognitive processes in the MDMP are unnecessary to prove that a simulation can support planning.

2. Simulation can improve plan visualization and communication through enhanced contingency analysis and plan dissemination.

3. Realistically modeling battlefield functions and processes is the first priority in developing a simulation to support the MDMP. Using the simulation for text-based OPORD production may waste resources.

3.3.2 Framework Development Limitations

The framework development attempts to detail attributes necessary for a user to create, edit, and war-game multiple COAs in a collaborative, tactical environment. The framework does not include GUI considerations such as input method. Nor does it include functions necessary to allow a user to completely publish an OPORD at the conclusion of the MDMP. It also does not account for hardware considerations or advanced decision support. Automated terrain analysis, route planning, and COA selection/analysis such as what is being developed for the ICCES program may greatly improve tactical planning in the near future. However, including computer decision-making is premature at this point because no clear standards exist. Furthermore, this research does not address the technical feasibility of doctrinal requirements for a simulation to support the MDMP.

3.3.3 Task Analysis from the MTP

Each ARTEP 7-30-MTP task has sources listed. However, many tasks overlap in various areas of the seven steps of the MDMP or do not relate to war-gaming in a tactical setting. For example, the task “Conduct S4 Operations” includes all steps of planning and execution. It lists many operations and assignments separate from planning such as monitoring other activities, battle tracking (maintenance of maps, supplies, and facilities), and coordination. As the doctrine is decomposed, these irrelevant portions are discarded.

Adapting doctrine to simulation requires qualified judgment. In developing the criteria, subjective tasks and bookkeeping tasks that are very important to the MDMP have been omitted. For example, during mission analysis, the staff must keep track of the commander’s guidance, facts and assumptions, specified and implied tasks, and issue text-based products. These things, with the exception of text products, are difficult if not impossible to model. Therefore, the framework is focused on increased COA analysis through war-gaming to better visualize and

communicate contingencies. The framework largely ignores subjective and text-based measures.

3.3.4 Establishing Framework Metrics

Decomposing the steps of each relevant task from ARTEP 7-30-MTP provides the required products and capabilities of each staff officer and the collective group during the MDMP. Again, there are many tasks that do not directly relate to simulation that will be excluded from the analysis. These tasks are typically cognitive processes performed by staff officers. Assessments of capabilities, developing and issuing guidance and intent, and developing of facts and assumptions are all critical functions that may not be represented in simulation.

Furthermore, basic ideas and assumptions that are taken for granted in the military planning process are very difficult to implement in simulation. Maps are the most obvious example. During operations, soldiers use maps that are standardized 1:50,000 UTM projections. These maps are usually plentiful and easily changed depending on the location and time available. Still, contingency operations

in unmapped regions of the world provide planning difficulties at lower levels. These problems persist until maps of the area are created and disseminated. This problem is compounded in simulation. Digital terrain standards exist but it may take months to create representations with the required detail necessary for accurately modeling entity behaviors. Staffs cannot wait on maps for contingency operations. Planning tools must be as flexible and as fast as today's Operational Tempo (OPTEMPO) demands. Still, simulation is only useful if it accurately models entity behaviors on realistic terrain. The tool must give a good possible solution to multiple COA iterations. Therefore, development of measures of METT-TC and Intelligence Preparation of the Battlefield (IPB) become very important.

As discussed in chapter two, simulation capabilities of flexibility, interoperability, entity behavior, recording, and decision support may improve the MDMP. Therefore, the framework in Appendix E includes these additional categories. Figures 1.1 and 2.1 show all 12 major categories of the framework developed in appendix E.

3.3.5 Establishing Measures for each Metric

Users or military program managers may want to know how well a simulation supporting the MDMP measures up to the functionality criteria established here. Therefore, a metric[7] must be established to determine the applicability of the criteria to each area of the MDMP and simulation strength. This is a large task in itself and will be reduced and simplified for the purposes of this research.

The questions, measures, and associated metrics in the framework of Appendix E attempt to determine if the simulation supports the MDMP. However, they do not examine how well the simulation supports the MDMP. This is a key simplification in the framework. For example, category 1, Mission Receipt, requires the simulation to incorporate higher unit graphics. It measures this by accounting for all graphical symbols in FM 101-5-1. It does not specify what “electronic overlays” must be incorporated because these ideas have not been defined. We can assume that overlays will take the same form in the digitized MDMP but

[7] The metric states what the simulation must model to support the category while the measure determines whether it does or not.

that would be premature. It would also inhibit application of the framework to future problems. For each measure, the framework does not limit its applicability by specifying "how" it must model something. Instead, the framework states "what" the simulation must model to support the associated phase of the MDMP.

The measure for each metric is derived using the Basili and Rombach (1988) method of Goal-Question-Metric. The creation of the metrics is facilitated through questions supporting the goal of the research. Furthermore, the questions on the survey cover sheet (appendix D) serve as a link from the doctrinal MOE to the metric. These questions are:

1. Does the simulation accurately represent terrain in sufficient detail for planning?

2. Does the simulation accurately model brigade and below operations / behaviors for each Battlefield Operating System (BOS)?

3. Does the simulation facilitate tactical planning as it exists today (particularly COA development and analysis as well as collaborative planning)?

4. Does the simulation enhance planning as it exists today by incorporating simulation strengths?

For criteria supported by doctrine, it is fairly easy to establish a qualitative “GO/NO-GO” measure. For example, if the simulation can model terrain features and characteristics defined in FM 5-33, *Terrain Analysis*, then it is a “GO” in that area. Observers can then easily see where the doctrine and the simulation do not agree.

However, for criteria not supported by doctrine, it is very difficult to establish a metric and associated measure. The five areas of simulation not supported by doctrine produce criteria that can be easily debated and refuted. This research does not have the luxury to perform detailed study of these critical issues. Therefore, the metric for the simulation’s flexibility, interoperability, entity behaviors, recording, and decision support abilities must be general until further study can be performed. The measures for the five areas are general:

1. Flexibility – the simulation must be able to simulate, run, or display a COA scenario in approximately 20 minutes for it to be useful. Scenario length would be user determined. There are a few ways to look at this:
    a. Offensive Operations. Actions on the Objective (Assault position to the Limit of Advance).
    b. Defensive Operations. Reconnaissance fight through Consolidation and Reorganization.

c. Stability and Support Operations (SASO). The simulation should be used for modeling events /contingencies and force structure alignment such as for Cordon and Search (Assault position to Consolidation & Reorganization). Otherwise, it should model an event (attack on a friendly Roadblock / Checkpoint).

For a three-hour operation, this would result in about 9:1 compression of time. In this way, multiple COAs can be war-gamed before the decision must be made. Human in the loop interaction must be possible while the simulation is running. The simulation must also be capable of executing turn-based interaction.

2. Interoperability – Army Regulations largely govern this area. AR 5-11 states all new simulation / C4I requirements in terms of interoperability. As it is updated, it will presumably still govern this area. Furthermore, the references included above suggest the simulation must run in stand-alone, linked, or networked modes aggregating from section to battalion sized operations. It also must manipulate graphics as specified above.

3. Entity Behaviors – The simulation has valid entity behaviors and is capable of interacting with terrain, graphical control measures, and other entities.

4. Recording – the simulation has a logging utility and databases for capturing data on each COA separately.

5. Decision support – not included in this analysis.

Appendix E contains the completed framework and proposed metrics. Steps of the MDMP and the five areas discussed above categorize these criteria. Each criterion includes a reference supporting its inclusion and a general

discussion of its measure. Several metrics have no reference. These metrics are included as general guidelines/common sense considerations. None of the references addressed in this research suggest the need for these metrics.

3.3.6 Discussion of Modeling Entity Behaviors

Appendix A only lists those tasks that are relevant to the MDMP. There are many other ARTEP 7-30-MTP tasks a brigade must perform to be successful in combat operations. These other tasks serve as excellent guidelines for modeling entity behaviors. OneSAF seeks to be able to accurately model brigade operations at an aggregated level. This includes command decisions and other factors. Understanding the way a brigade performs begins with doctrine. Human nature, historical data, and other factors will affect how entities are modeled. Certainly, accurate behaviors are very important for simulation acceptance and verification. However, defining behavioral criteria is beyond the scope of this thesis.

In defining user functionality criteria the author has largely ignored the idea of behaviors. This is because the user cannot get overly concerned with validation of behaviors. Users will demand that any simulation purporting to enable the MDMP has reasonable behaviors. However, validation, verification, and testing will determine acceptable entity actions under the varying simulation conditions.

Tasking and command decision modeling are extremely important when considering aggregated entity behaviors. Therefore tasking considerations are paramount in the framework. Most tasks are fairly easy, and extremely important, to model. Unit entities must “understand” what doctrinal tasks mean when applied to an object. Modeling the doctrinal tasks required of simulated entities is not an easy proposition. Many experienced officers will argue over the subtle differences between the tasks fix, suppress, and contain. Modeling all possible tasks correctly is paramount to user acceptance. Furthermore, the user must be able to specify the level of success the entity must perform the task. This is a fuzzy concept that

takes careful study to quantify and implement in a simulation. Similarly, entities must “recognize” the critical concepts of a decisive point and main effort. Users should also be able to specify priorities of logistical and fire support to various unit entities as they would in the real world.

Command decision modeling is also a critical behavior required in a simulation supporting the MDMP. Commanders influence the battle through their presence, allocation of fires, and use of the reserve. Correctly modeling these items is very difficult and extremely important. It is difficult to define, quantify, and translate to a simulation the commander’s influence on the unit he is with in the heat of battle. Harder still is defining the reallocation of fires at a critical point in the battle. Fortunately, reserve commitment criteria is a standard, well-defined concept and easier to implement. The framework does not include modeling command decision-making. More research is necessary in this area. Commanders make decision using cognitive processes. These

decisions require expert experience, judgment, and responsibility that are difficult to quantify and model.

3.3.7 Survey Technique

SME review helps to eliminate bias from the framework. Expert acceptance or input into the criteria metrics will benefit this research by validating the concepts and methodology. Therefore, the criteria will be evaluated through a survey by appropriate SME. These SME must be knowledgeable in Army tactical operations, the MDMP, and simulation.

Floyd J. Fowler's *Survey Research Methods* guides the development of a survey instrument (Appendix D). As Fowler states, "Design of a survey involves a set of decisions to optimize the use of resources," (Fowler, 1993, 7). Therefore, the survey is carefully crafted to get the maximum amount of data from key individuals. SME review the criteria and fill out the survey form. Surveys are incorporated into the results as evaluation feedback and lessons learned. Qualitative, open questions are best for an ill-defined problem such as the one being investigated

in this research. Fowler's five critical survey issues of total survey design and the approach to them are as follows:

1. A probability sample is not used. Open questions eliciting qualitative data will allow SME free response.

2. The sample frame is individuals with experience in developing tactical simulation and knowledgeable in small unit tactics and the MDMP.

3. The size of the sample is small due to limited resources.

4. The sample design is by mail.

5. The rate of response is discussed in chapter four, Results.

The SME survey in Appendix D attempts to address the framework in a hierarchical manner. In developing it, I first chose to examine the structure of the framework as a whole. Therefore, the initial question asks the expert to consider MDMP doctrine as an appropriate basis for a simulation to support the MDMP.

Questions 2-13 require the expert to examine each category for clarity, completeness and correctness of the metric. Additionally, questions 9-13 stimulate the expert to examine the five areas which simulation may add to the

planning process as discussed in chapter 3. Question 14 asks the expert to consider whether a simulation meeting the framework criteria would properly support the user.

These questions are deliberately formulated for qualitative data analysis and collection. If the SME disagrees with the framework or a single category, he may add to it, change all or part of it, or delete it. Furthermore, the SME is given an opportunity to reflect on the nature of the subject being examined. The qualitative nature and novel approach of the framework necessitate free thought by the respondent. Seven military officers first completed the questionnaire in appendix F as a pilot survey. This pilot survey provided many insights into the development of the final product. The pilot survey questioned officers from Armor, Engineer, Aviation, and Ordnance branches.

The TRADOC Analysis Center (TRAC) builds tactical and operational simulations for analyzing future concepts. Many TRAC administrators are senior Army officers with years of field experience. These officers, combined with doctrine and simulation developers and researchers (both

civilian and military) from other organizations, are intended to establish a specific survey frame. Survey (Appendix D) and framework (Appendix E) respondents include:

1. LTC Robert J. Domitrovich, Jr., PhD., Command and Control Doctrine chief and author, FM 5-0, Combined Arms Doctrine Directorate (CADD), Fort Leavenworth, KS.

2. MAJ John R. Surdu, PhD., Information Analysis and Evaluation Officer, United States Military Academy (USMA) Information Technology and Operations Center (ITOC), West Point, NY.

3. Mr. Eric Johnson, Analyst, Future Concepts Directorate, TRAC, Fort Leavenworth, KS.

4. LTC Michael Wilmer, Senior Military Analyst, Model Management and Development Directorate, TRAC, Fort Leavenworth, KS.

5. LTC Steve Riese, PhD., Division Chief, Advanced Technology Division, TRAC, Fort Leavenworth, KS.

6. LTC John Lee, Senior Military Analyst and Deputy Director, TRAC, Fort Leavenworth, KS.

7. Mr. Greg Schow, Principal Investigator, STRICOM.

3.4 Objective, Benefits, and Limitations of the Proposed Criteria

Using the methodology above, this thesis develops doctrinal functionality criteria for a simulation to

support COA analysis in the MDMP. These criteria may then be adapted as system requirements. Successfully converting doctrine to requirements is the crux of designing a simulation to support the MDMP. The criteria must be clear to users and developers. Experts knowledgeable in both simulation and combined arms doctrine must accept and approve it. When based on doctrine and approved by subject matter experts, these criteria can serve as the basis of a requirements document for developing simulations such as JMACE (Mackinnon, 2000).

The scope of these criteria is limited to light and mechanized infantry operations including armor. More study is necessary to determine how it will differ for Aviation, Special Forces, RANGER, and other maneuver elements. Furthermore, modeling combat support and combat service support units is not the priority of this paper. However, the author made every attempt to present a total combined arms view in developing the criteria. As discussed earlier, the criteria are also not GUI or hardware focused. This research also does not focus on an MDMP simulation tool's impact on OPORD products. Ideally such a tool would

make OPORD production and briefing much simpler. Furthermore, the framework does not examine cognitive processes that the staff and commander may be required to develop by FM 5-0.

The criteria are limited to brigade and below operations. Many other factors impact on division and above operations than can be included (due to time constraints) in this research. Furthermore, the thesis does not establish the objects required for computer code creation.

CHAPTER 4: RESULTS

4.1 Survey Results Overview

The surveys completed by each SME are located in Appendix H. Of the seven survey respondents, five fully completed the survey by answering the questions and examining the framework in detail. One expert gave only general comments and did not specifically address any elements of the framework. Another SME made comments on the framework and summarized them in a separate document without completing the survey. Therefore, while the survey response rate is 100%, not all SME answered every question. For this reason and to assist in analyzing the surveys, the results are divided into three sections—major category, sub-category, and trends results. This division allows for a hierarchical study of the framework. Major and sub category analysis includes six responses. The trends results enable analysis of all seven SME responses in a clear, concise format. A summary of all comments is located in Appendix F.

A circle agreement graphic demonstrates major SME disagreement with that portion of the framework. Five circles represent no disagreement with the category/sub-category. One circle demonstrates strong SME disagreement with the category or sub-category. Two, three, or four circles correspondingly indicate relative levels of disagreement with a category or sub-category. Generally, a significant disagreement comment (add, change, or delete) by a SME results in the loss or one circle for each category or sub-category. With open questions inviting free response, subjective judgment in some cases determines the nature of the comment. This will be discussed more in Chapter 5. However, the summary of all comments in Appendix F indicates how the comments were interpreted.

4.2 Major Category Results

The major category results are depicted in Figure 4.1. Major category results address only question one of the SME survey. This question attempts to elicit from the SME if the overall methodology (of using the steps of the MDMP with the 5 additional areas discussed in chapter 3)

for framework development is appropriate. The circle agreement graphic indicates relative level of agreement. A percentage scale relates the SME acceptance of the major category. Figure 4.1 shows that two survey answers recommended a significant change to a major category. Three survey answers stated that two major categories should be deleted from the framework. Additionally, two responses suggested that a major category be added for a simulation to properly support the MDMP.

Category	Agreement	Add	Change	Delete	Percent
1. Mission Receipt	⬭⬭⬭⬭⬭				100%
2. Mission Analysis	⬭⬭⬭⬭⬭				100%
3. COA Development	⬭⬭⬭⬭		1		85.7%
4. COA Analysis	⬭⬭⬭⬭		1		85.7%
5. COA Comparison	⬭⬭⬭⬭⬭				100%
6. COA Briefing and Approval	⬭⬭⬭⬭⬭				100%
7. Orders Production and Briefing	⬭⬭⬭⬭⬭				100%
8. Flexibility	⬭⬭⬭⬭⬭				100%
9. Interoperability	⬭⬭⬭⬭			1	85.7%
10. Entity Behaviors	⬭⬭⬭			2	71.4%
11. Recording	⬭⬭⬭⬭⬭				100%
12. Decision Support	⬭⬭⬭⬭⬭				100%
Completeness	⬭⬭⬭	2			71.4%

Figure 4.1, Major Category Results

The comments regarding major categories are summarized below.

1. CHANGE – COA Development (3) - LTC Wilmer stated that the COA Development category should be restructured to explicitly follow the doctrinal steps of COA development.

2. CHANGE – COA Analysis (4) – LTC Riese recommended dividing this category into staff estimates and war-gaming.

3. DELETE - Interoperability (9) – MAJ Surdu implied this should not be a major category.

4. DELETE – Entity Behaviors (10) – LTC Wilmer implied this should not be a major category.

5. DELETE – Entity Behaviors (10) – MAJ Surdu implied this should not be a major category.

6. ADD - MAJ Surdu stated that the framework must have a major category requiring simulation AAR and Rehearsal support.

8. ADD – LTC Riese stated that Commander's guidance should be an additional category.

4.3 Sub-Category Results

Sub category results are located in Appendix G. These graphics indicate SME level of agreement with each sub-category within the 12 major categories. The analysis centers on SME agreement with the metric for each category using the circle scale. However, many SME comments cannot

be characterized as strictly negative. Therefore, neutral comments and suggestions for further research are included in sub-category results analysis. The comments included in the sub-category don't address measures. Measures responses are addressed in the trends analysis.

AGREE-MENT	TALLY	ADD	CHANGE	DELETE	NEUTRAL	FURTHER RESEARCH
○	2 (2.9%)	6	3		2	
○○	1 (1.5%)	1	2			
○○○	7 (10.3%)	3	8	2	1	
○○○○	27 (39.7%)	9	10	1	8	1
○○○○○	31 (45.6%)				1	

Figure 4.2, Sub-Category Results Summary

The summary of sub-category results located in Figure 4.2 shows little disagreement with the majority of categories. Figure 4.2 depicts the number of sub-categories receiving each circle rating as a tally of the total. Again, this roughly equates to the number of significant SME comments for that sub-category measure. Of the 68 sub-categories, 58 show little or no disagreement. The remaining 10 sub-categories are addressed in trends analysis.

4.4 Trends Analysis

Trends in SME comments are areas where more than two SME made a significant disagreement comment. The trends analysis provides depth in the feedback because it is not limited by the categories and sub-categories. A trend may not involve a consensus of opinions. A consensus is indicated when three or more SME indicate that the same thing should be changed. The number of comments relating to a sub-category may not correspond to the trend in that area. For example, three SME addressed entity behaviors outside of that category. When combined with the major category analysis, the sub-category trends provide an easy vehicle to adjust the framework. If a trend indicates significant disagreement, it can be examined further. The results will be a change in the framework, explanation of the difference, or, at a minimum, recording of a major difference.

Each trend is addressed below.

1. Refine measures – Strong consensus. Five SME stated the measures were unsatisfactory. Most experts felt that a simulation could not be expected to do all of something. A GO / NO-GO metric restricts developers in establishing compromise between performance and functionality and is not appropriate.

2. Add commander’s guidance – Consensus. Four SME stated that the framework did not adequately capture the commander’s role in the MDMP. The SME want text-based products to capture commander’s intent and planning guidance. Furthermore, one SME expressed that a simulation supporting the MDMP must completely incorporate the higher OPORD upon mission receipt to include higher commander’s intent.

3. Add text-based products – Consensus. Three SME explained that the simulation must allow for creation or loading and distribution of text-based OPORD products.

4. Expand / refine COA development – No consensus. Three experts asserted that this category was lacking. Two experts suggested it was too detailed for a simulation to effectively balance execution time with functionality. One of these experts suggested that behaviors were not sufficiently addressed in this category. The third comment asserted that COA development and analysis should be integrated with the output being the decision brief.

5. Refine COA analysis – No consensus. 5 SME indicated that portions of the COA analysis category of the framework should be reexamined. These comments did not identify any consistent fault but were mainly centered on the models and methods. Two experts implied COA analysis should be completely automated. Also, six significant comments questioned the necessity or feasibility of modeling portions including weather, priorities of support, SOPs, and recording. Two experts wanted the framework requirement of branch and sequel analysis to be expanded.

6. Add to COA comparison – Consensus. Three SME asserted that the simulation must allow changes to COA comparison criteria including keeping track of subjective criteria.

7. Refine interoperability – No consensus. Three experts disagreed with major portions of this category. One SME asserted that interoperability should not be a category. One questioned the requirements of AR 5-11. One expert felt that platforms should be explicitly addressed in the framework. One of these experts felt that interoperability should be strictly focused on the simulation interfacing with C4I systems and not commercial operating systems.

8. Refine entity behaviors – No consensus. Two experts stated this should not be a category. One of these SME suggested this category be addressed in COA development and analysis. His concern was that behaviors be as simple as possible to ensure simulation repeatability. A third expert stated there is much difficulty in assigning SOPs to entities.

CHAPTER 5: CONCLUSIONS

The framework developed in this research is a start towards improving the MDMP through simulation. Through the use of carefully constructed simulation tools, tactical staffs may be able to enhance contingency planning and increase visualization on the battlefield. Simulation supported planning may also improve collaborative planning, briefing, analysis, and dissemination of tactical problems.

5.1 Interpretation of Results

Figure 4.1 and 4.2 indicate that the SME surveyed generally had a high level of agreement with the framework. However, they also had several significant problems with the product of this research. Findings indicate the addition of two categories is appropriate. The initial framework did not emphasize the importance of collaborative planning, bookkeeping for subjective staff assessments, or text-based products—specifically commander’s intent and guidance. Furthermore, the SME suggested numerous changes to the metrics and wording of the framework.

Experts' comments enhance the framework. The updated framework (appendix I) and actions taken on the SME comments in appendix F reflect these changes. Additions in bold-faced, underlined type in the updated framework of appendix I resulted from the survey. Almost all recommendations for addition to the framework and diction choices are now included. Most addition comments added necessary detail to the framework. Conversely, no deletion recommendations have been incorporated in the new framework. There is no strong consensus between SME to delete framework items.

Furthermore, many items of SME concern must be left for further research. Measures have been changed in accordance with SME consensus but more research is necessary into this important topic.

5.2 Recommendations

This research recommends the development of a simulation in support of the MDMP. Appendix I can serve as a good starting point for a requirements document. It is intended to serve as a set of minimum requirements

for end-user functionality. Focusing efforts on existing doctrine and current user needs may enable development of a product capable of supporting the current, well-defined and well-understood MDMP. Waiting for new doctrine and embedded decision support capabilities may delay creation of such an important and necessary tool. Furthermore, developing tools for doctrine and processes that are not well understood may result in poor user acceptance of the simulation as well as difficulties in validating the simulation.

Measures for each metric must be adequate and documented. When evaluated, appropriate measures illustrate the simulation's capabilities and limitations so that the user can understand the planning tool better. In considering a new metric, this research concludes that a percentage of completeness scale would be more appropriate. This scale would be based from 0-100 and document how well the simulation supports each measure. As discussed previously, the measure issue requires more research but appendix I reflects metric recommendations. A completion

percentage measure is more appropriate than a cardinal, ordinal, or the initial binary measure.

5.3 Lessons Learned

All lessons learned in this research focus on clarifying the survey instrument. The lessons learned in this research are as follows:

1. Conduct a focus group to anticipate concerns. The survey method proved to be successful. However conducting a focus group prior to the pilot survey may have been of significant benefit. Some of the officers in the pilot survey had significant questions that had to be clarified. The pilot survey was not successful in clarifying some major problems with the framework. Furthermore, the Delphi technique of survey implementation may have improved SME understanding and evaluation of the framework through a more focused iterative approach.

2. Conduct surveys in person. The survey was implemented by mail. Conducting the surveys in person as an interview may have provided simplification on key points the SME needed clarified. Unfortunately, resource limitations precluded personal interviews.

3. State all assumptions in the survey instructions. Products (such as appendix I) attempting to state requirements must be as explicit as possible. The initial survey did not include the inherent assumptions of section 3.3.1. For example, three of the SME found that text products must be included in a simulation supporting the MDMP. The framework development process resulted in four unsatisfactory products before appendix E was developed. An early version of the framework included all text-based

products of the current MDMP. However, the framework sent to SME assumes that text-based products would detract from the primary purpose (contingency analysis) for a simulation in support of the MDMP. The simulation platform (PC or otherwise) would be unavailable for COA analysis while necessary text entry was being performed. This is particularly a consideration in light infantry units where resources are extremely limited. This assumption can be interpreted as, "Why read an OPORD COA when you can see a simulation of it?"

5.4 Suggestions for Further Research

Potential simulation decision support capabilities have not been considered in this research. Army projects are currently being developed to automate planning considerations including terrain analysis, COA development and analysis, and route selection. Furthermore, the assumptions in chapter three for framework development must be validated. The subject of balancing simulation capabilities against performance has not been addressed in this research. There are many SME critiques of this balance in the current framework. A literature review and development of a method of ensuring optimal balance is important to an MDMP simulation's functionality. There may be less tolerance for inadequate modeling in a simulation supporting the MDMP than in current training simulations.

If the criteria framework in Appendix I is an accurate estimation of simulation requirements, it will take years to develop and integrate these capabilities into a fielded prototype. Before that can happen, the general framework must be converted to object oriented code. This requires a more detailed analysis of each area and the creation of a data dictionary. Also, study of the technical feasibility of framework items is necessary for concept validation. A case-based objective evaluation of OneSAF or other simulations using the framework may provide insight into simulation support of the MDMP as well as strengths and weaknesses of the framework. This was an initial goal of this research that was cancelled due to time constraints.

SME comments in Appendix F provide a good list of future research topics. An MDMP support tool must also support OPORD production and interface with existing and objective systems. This may enable increased speed and efficiency of communications. Further study is necessary to determine additional user requirements. Different GUI and hardware configurations may affect user acceptance and system performance and should be studied.

APPENDIX A, STEPS OF THE MDMP

STEP	TASK	SOURCE	TASK NUMBER
Step 1	Receipt of Mission		
	Conduct Military Decision-Making Process	TSP 71-6-B-9901	71-6-0005.07.00KB
Step 2	Mission Analysis		
	Conduct Intelligence Operations		07-6-1903
	Conduct S2 Operations		07-6-1904
	Conduct Intelligence Preparation of the Battlefield		34-1-2003.07-1609
	Produce Intelligence Products		34-6—2004.07-1605\
	Conduct S3 Operations		07-6-1905
	Prepare Staff Estimates	FM 101-5 ST 100-9 STAFEX TSP 71-2-B-9910 TSP 71-6-A-0002 TSP 71-6-A-0007 TSP 71-6-A-9904 TSP 71-6-A-9909 TSP 71-6-B-9909 TSP 71-6-C-9901 TSP 71-6-D-9901	71-6-0004.07-00KB
	Conduct S1 Operations		07-6--1902
	Conduct S4 Operations		07-6-1906
	Develop the Engineer Estimate		71-6-2651.07-00KB
	Develop River Crossing Plan		71-6-2651.07-00KB
	Prepare ADA Staff Estimate		71-6-3101.07-00KB
Step 3	Course of Action Development		
	Perform Top-Down Fire Planning		06-1-W300.07-1620
	Conduct Targeting Process		06-1-W304.07-1622
	Synchronize Fire Support		06-1-W308.07-1624
	Synchronize Close Air Support		71-6-0307.07-1640
Step 4	Course of Action Analysis		
Step 5	Course of Action Comparison		
Step 6	Course of Action Approval		
Step 7	Orders Production		
	Develop Operations Order		71-6-0050.07-00KB
	Prepare Fragmentary Orders		71-6-0051.07-00KB
	Prepare Obstacle Plan as an Annex		71-6-2657.07-00KB

APPENDIX B, CALL MDMP TIMELINES

ACCELERATED TECHNIQUE

RECEIVE MISSION	
SEND WARNING ORDER NO. 1	
MISSION ANALYSIS	.5 HOUR
MISSION ANALYSIS BRIEF	.25 HOUR
SEND WARNING ORDER NO. 2	
DEVELOP COAs/HASTY WARGAME	1 HOUR
RECEIVE CDR'S GUIDANCE	1 HOUR
SEND WARNING ORDER NO. 3	
COA ANALYSIS	1 HOUR
COA COMPARISON	N/A
COA DECISION BRIEF	N/A
SEND WARNING ORDER NO. 4	
ORDER PREPARATION	1 HOUR
ORDER APPROVAL	.5 HOUR
ORDER REPRODUCTION	1 HOUR
ISSUE ORDER	1 HOUR
CONFIRMATION BRIEF TO CDR	.5 HOUR
BACKBRIEF	.75 HOUR
REHEARSAL	1 HOUR

ABBREVIATED TECHNIQUE

RECEIVE MISSION	
SEND WARNING ORDER NO. 1	
MISSION ANALYSIS	1 HOUR
MISSION ANALYSIS BRIEF	.5 HOUR
RECEIVE CDR'S GUIDANCE	.75 HOUR
SEND WARNING ORDER NO. 2	
DEVELOP COAs/HASTY WARGAME	1.5 HOUR
COA ANALYSIS	1.5 HOUR
COA COMPARISON	.5 HOUR
COA DECISION BRIEF	.5 HOUR
SEND WARNING ORDER NO. 3	
ORDER PREPARATION	1.5 HOUR
ORDER APPROVAL	.5 HOUR
ORDER REPRODUCTION	2 HOUR
ISSUE ORDER	1.5 HOUR
CONFIRMATION BRIEF TO CDR	.5 HOUR
BACKBRIEF	.75 HOUR
REHEARSAL	1.5 HOUR

DELIBERATE TECHNIQUE

RECEIVE MISSION	
SEND WARNING ORDER NO. 1	
MISSION ANALYSIS	1.75 HOURS
MISSION ANALYSIS BRIEF	.75 HOURS
RECEIVE CDR'S GUIDANCE	.5 HOUR
SEND WARNING ORDER NO. 2	
DEVELOP COAs/HASTY WARGAME	2 HOURS
COA ANALYSIS	3 HOURS
COA COMPARISON	.75 HOUR
COA DECISION BRIEF	1 HOUR
SEND WARNING ORDER NO. 3	
ORDER PREPARATION	2 HOURS
ORDER APPROVAL	1 HOUR
ORDER REPRODUCTION	2 HOURS
ISSUE ORDER	2 HOURS
CONFIRMATION BRIEF TO CDR	.5 HOUR
BACKBRIEF	.75 HOURS
REHEARSAL	2 HOURS

APPENDIX C, ARTEP 7-30-MTP EXTRACT

NOTICE:

This document is generated from relational data submitted by the proponent.

Questions relating to information displayed should be addressed to the proponent school.

TASK: Conduct Military Decision-Making Process (Brigade/Battalion) (71-6-0005.07-00KB) (TSP 71-6-B-9901)

ITERATION 1 2 3 4 5 M (circle)
TRAINING STATUS T P U (circle)

CONDITION: The unit is preparing for or has been engaged in an operation. The unit has received the higher HQ OPORD/OPLAN and operations have commenced. The main CP is operational and all staff sections are functioning. Combat intelligence and unit reports are flowing through communications channels.
Some iterations of this task should be performed in MOPP4.
TASK STANDARD: Staff analyzes the mission. Commander issues his guidance. All WOs are issued allowing time for subordinate units to plan. COAs are developed and wargamed. The recommended COA is briefed to the commander and approved by him. The OPORD is prepared and issued.

TASK STEPS and PERFORMANCE MEASURES	GO	NO GO
NOTE: The commander and each staff section do estimates continuously to provide important inputs for the MDMP. Estimates are revised when important new information is received or when the situation changes significantly. *1. Commander and staff receives an order or anticipates a new mission. NOTE: The new mission may come from an order issued by higher headquarters or derived from an ongoing operation. a. S3 section issues a WO to the staff alerting them of the pending planning process. Unit SOPs identify? (1) Who is to attend. (2) Who the alternates are. (3) Where they should assemble. b. Staff prepares for mission analysis immediately on receipt of the WO by gathering tools necessary to conduct mission analysis. These include? (1) Higher headquarters' plan or orders, with graphics. (2) Maps of the AO. (3) Both own and higher headquarters' SOPs. (4) Any existing staff estimates c. XO coordinates staff actions required to ensure staff estimates are current and staff elements have necessary mission analysis tools available. d. Commander and staff complete a quick initial assessment. This assessment? (1) Determines the time available from mission receipt to mission execution. NOTE: The most critical product of the assessment is an initial allocation of available time. As a general rule, the commander allocates a minimum of two-thirds of available time for subordinate units to conduct their planning and preparation. (2) Determines the time needed to plan, prepare for, and execute the mission for own and subordinate units. (3) Determines the IPB.		

NOTE: IPB is an ongoing process, proceeding simultaneously with other steps in the MDMP. Changes are dictated by METT-TC and MDMP requirements. (4) Determines the staff estimates already available to assist planning. (5) Ambient light requirements for planning, rehearsals, and movement. (6) The staff's experience, cohesiveness, and level of rest or stress. e. Commander determines whether time permits conduct of the full MDMP, or to abbreviate the process. f. Commander issues his initial guidance. Guidance should include as a minimum? (1) How to abbreviate the MDMP, if necessary. (2) Initial time allocation. (3) Liaison officers to dispatch. (4) Initial reconnaissance to begin. (5) Authorized movement. (6) Additional tasks the commander want the staff to accomplish. g. S3 section issues a WO to subordinate and supporting units. The WO includes as a minimum? (1) Type of operation. (2) General location of the operation. (3) Initial time line. (4) Any movement or reconnaissance to initiate. NOTE: Parallel planning is a routine procedure for the MDMP. h. XO coordinates dispatch of liaison personnel as directed. i. S2 section continues IPB and begins development of the R&S plan. *2. Commander and staff conduct mission analysis with concurrent continuation of staff estimate development. a. Analysis should ensure understanding of? (1) The higher headquarters' commander's intent, two levels up. (2) The mission, including tasks, constraints, risk, available assets, and AO. (3) Conception of the operation, including the deception plan. (4) Timelines for mission execution. (5) The missions of adjacent (to include front and rear) units and their relation to higher headquarters' plan. (6) The assigned AO. NOTE: If confused by the higher headquarters' order or guidance, the staff must seek clarification immediately. b. S2, in coordination with the commander and staff, conducts IPB. (1) Develops the modified combined obstacle overlay (MCOO) and enemy SITTEMPs. (2) Develops initial intelligence collection plan. (3) Provides all intelligence products to subordinates as they are usable, even if only partially complete. c. XO and staff? (1) Develop specified and implied tasks. (2) Conduct task analysis. (3) Develop essential task list. d. Commander and staff review available assets? (1) Additions to and deletions from the current task organization. (2) Support relationships. (3) Status to determine additional resources needed for mission success. e. Commander and the staff identify and understand constraints that restrict their freedom of action		

f. S3 section, in coordination with the staff, gathers information concerning assigned task(s) and develop facts and assumptions. NOTE: Facts are statements of know data concerning the situation, including enemy and friendly dispositions, available troops, unit strengths and material readiness. NOTE: Assumptions are suppositions about the current or future situation that are assumed to be true in the absence of facts. Assumptions are replaced with facts as soon as possible. When possible, assumptions are cleared with higher headquarters to ensure consistency with the higher headquarters plan. g. Commander and staff identify accident risk hazards and make the initial assessment of the risk level for each hazard. h. Commander makes an initial assessment of where he might take tactical risk. i. Staff nominates information requirements to become initial commander's critical information requirements (CCIR). j. Commander selects his CCIR based on his experience, the mission, the higher commander's intent and input from the staff. NOTE: CCIRs most often arise from the IPB and war gaming. k. S2, in coordination with the staff, based upon the initial IPB and CCIR? (1) Identifies gaps in the intelligence available. (2) Determines initial R&S plan to acquire information based on available reconnaissance assets. l. S3 turns the R&S plan into an initial reconnaissance annex and launches reconnaissance assets. NOTE: As more information becomes available, it is incorporated into a complete reconnaissance annex for the OPORD. m. Commander and staff? (1) Refine their initial plan for the use of available time. (2) Specify when and where they will conduct briefings that result from the planning process. (3) When, where, and in what form they will conduct rehearsals. n. XO (or the S3) prepares a restated mission for the unit based on the mission analysis. o. XO and staff conduct mission analysis briefing to the commander, time permitting. The mission analysis briefing should include as a minimum: NOTE: If possible, the entire staff should be present for the briefing. (1) Higher headquarters' mission and higher commander's intent. (2) Higher headquarters' deception plan/objective. (3) Commander's initial guidance. (4) Initial IPB. (5) Specified, implied, and essential tasks. (6) Constraints on the operation. (7) Forces available. (8) Facts and assumptions. (9) Possible risk. (10) ‹@ Initial CCIR. (11) ‹@ Time available. (12) ‹@ Recommended restated mission. p. Commander approves the restated mission. q. Commander develops his initial intent for the operation during the mission analysis briefing. (1) Modifies it accordingly after review of the mission analysis and the restated mission. (2) Prepares his intent statement and, when possible, delivers it along with the order, face-to-face. r. Commander issues commander's guidance. NOTE: Additional information may be required based upon the commander's estimate and/or the experience of the staff.		

(1) Focuses on the essential tasks supporting mission accomplishment. (2) Includes priorities for all combat, CS, and CSS elements and how he envisions their support of his concept. (3) As a minimum it should address? (a) Specific COA to consider or not to consider, both friendly and enemy, and the priority for addressing them. (b) CCIR. (c) Reconnaissance guidance. (d) Risk guidance. (e) Deception guidance. (f) Fire support guidance. (g) Mobility and countermobility guidance. (h) Security measures to be implemented. (i) Additional specific priorities for CS and CSS. (j) Any other information the commander wants the staff to consider. (k) Time plan. (l) Type of order to issue. (m) The type of rehearsal to conduct. s. S3 section issues a WO to subordinate and supporting units that includes as a minimum? (1) Restated mission. (2) Commander's intent. (3) Unit's AO (sketch, an overlay, or some other description). (4) CCIR. (5) Risk guidance. (6) Reconnaissance to be initiated by subordinate units. (7) Security measures. (8) Deception guidance. (9) Mobility and countermobility guidance. (10) ‹@ Specific priorities. (11) ‹@ Time plan. (12) ‹@ Guidance on rehearsals. t. Commander and staff? (1) Periodically review all available facts and assumptions for new or changed information. (2) Assess the impact of the changes on the plan. (3) Make the necessary adjustments. 3. Staff, upon receipt of the commander's guidance, develops COAs for analysis and comparison. a. During COA development, the commander and staff continue the risk management process. b. S3, in coordination with the staff, develops COAs by? (1) Analyzing relative combat power. (2) Generating options. (3) Arraying initial forces. (4) Developing the scheme of maneuver. (5) Assigning headquarters. (6) Preparing COA statements and sketches. c. S3 ensures COAs are screened to meet the criteria of? (1) Suitability. (2) Feasibility. (3) Acceptability. (4) Distinguishability.		

(5) Completeness. d. S3, under direction of the XO, briefs the COAs to the commander for review (optional). 4. Staff conducts the course of analysis or war gaming process for each COA and begins the development of a detailed plan while analyzing its strengths and weaknesses. a. XO coordinates the actions of the staff. b. S1 analyzes COAs to project potential personnel battle losses and determine how CSS provides personnel support during operations c. S2 role-plays the enemy commander: (1) Develops critical enemy decision points in relationship to the friendly COA. (2) Projects enemy reactions to friendly actions. (3) Projects enemy losses. (4) Identifies information requirements. (a) Refines the event template to include NAIs that support decision points. (b) Refines the event matrix with corresponding decision points, TAIs, and high-value targets (HVT). (5) Refines situation templates (6) Participates in the targeting conferences and identifies HVTs as determined by IPB. d. S3 ensures the COA covers every operational aspect of the mission, records each event's strengths and weaknesses, and annotates the rational. e. S4 analyzes each COA to assess its sustainment feasibility and ensures that available movement times and assets will support the COA. f. Special staff officers help the coordinating staff by analyzing the COAs in their own areas of expertise, indicating how they can best support the mission. g. Time permitting, S3 and XO present a war-game briefing to ensure the staff fully comprehends the results of the war game. NOTE: During war gaming the commander may modify the COA based on how things develop. 5. Staff, under direction of the XO, compares the feasible COAs. a. Each staff officer analyzes and evaluates the advantages and disadvantages of each COA from his perspective and presents his findings for others' consideration. b. XO normally determines the weight of each evaluation criteria. c. Each staff officer may use his own matrix, however all must use the same evaluation criteria. d. Staff identifies the COA that has the highest probability of success against the most likely enemy COA. e. Staff identifies the most dangerous enemy COA. f. Staff, after completing its analysis and comparison, identifies its preferred COA and makes a recommendation. g. If the staff can not reach a decision, the XO decides which COA to recommend at the commander's decision briefing. h. S3 presents the decision briefing. The briefing includes as a minimum? (1) The intent of the higher headquarters (higher and next higher commander). (2) The restated mission. (3) The status of own forces. (4) An updated IPB. (5) Own COAs, including assumptions used in planning, results of staff estimates, and advantages and disadvantages including risk of each COA. (6) The recommended COA. *6. Commander receives briefing and analyzes all COAs. NOTE: If he rejects them, all the process must start over again. If the commander modifies a proposed COA or gives the staff a new one, the staff must war-game the revised or new one to		

derive the products that result from the war-gaming process. a. Commander decides on a COA he believes to be the most advantageous. (1) Refines his intent statement and CCIR, if required. (2) Issues any additional guidance on? (a) Priorities for CS or CSS activities (particularly for resources he needs to preserve his freedom of action and to ensure continuous service support). (b) Orders preparation. (c) Rehearsal preparation. (d) Preparation for mission execution. b. Commander decides what level of residual risk he will accept to accomplish the mission. c. Time permitting, the commander discusses the acceptable risks with adjacent and senior commanders. He must obtain the higher commanders' approval to accept any risk that might imperil the higher commanders' intent. d. S3 section issues a WO with essential information so that subordinate units can refine their plans. 7. Staff refines the selected COA, completes the plan, and prepares to issue the OPORD. a. S3 section, in coordination with the staff, prepares the order or plan to implement the selected COA. b. Staff assists subordinate staffs as needed with their planning and coordination. c. Staff implements accident risk controls by coordinating and integrating them into the appropriate paragraphs and graphics of the OPORD. It is essential to communicate? (1) How controls will be put into effect. (2) Who will implement them. (3) How they will fit into the overall operation. d. S3 section integrates staff input and finalizes the OPORD. e. Commander reviews and approves the OPORD. f. S3 section reproduces, distributes, and briefs as required. g. Commander and the staff conduct confirmation briefings with subordinates immediately following order issue to ensure subordinates understand the commander's intent and concept.		
NOTE * Indicates a leader task. NOTE + Indicates a critical task.		

TASK PERFORMANCE SUMMARY BLOCK

ITERATION	1	2	3	4	5	M	TOTAL
TOTAL TASK STEPS & PERFORMANCE MEASURES EVALUATED							
TOTAL TASK STEPS & PERFORMANCE MEASURES "GO"							

APPENDIX D, SME QUESTIONNAIRE

A Framework for Simulation Support of the MDMP
Master's Thesis by Andy Farnsler, 18-Dec-00

SUBJECT MATTER EXPERT SURVEY

GENERAL: Thank you for taking the time to participate in this survey. Your careful attention to the matters presented will greatly aid in my thesis research. This survey is intended for use by professionals knowledgeable in military planning and simulation. My thesis research identifies doctrinal criteria necessary for a simulation to support the tactical MDMP. I developed and arranged the attached initial criteria according to all available doctrinal and research references. The focus of this research is primarily on doctrinal and functional requirements of a simulation to support the MDMP and largely ignores Graphic User Interface (GUI), hardware, and joint doctrine issues.

INSTRUCTIONS: Please fill in your personal information on this page and complete the 14 question survey on pages 1-9 using the attached criteria. Should you need further information, have questions, or would prefer to take the survey electronically, please feel free to contact me at farnsler@hotmail.com or (407) 482-9621.

GOAL: The goal of this research is to develop doctrinal criteria for a simulation to support the Military Decision Making Process.

QUESTIONS: These criteria are meant to answer the following questions about a generic simulation made to facilitate the MDMP:

1. Does the simulation accurately represent terrain in sufficient detail for planning?
2. Does the simulation accurately model brigade and below operations / behaviors for each Battlefield Operating System (BOS)?
3. Does the simulation facilitate tactical planning as it exists today (particularly COA development and analysis as well as collaborative planning)?
4. Does the simulation enhance planning as it exists today by incorporating simulation strengths?

METRIC: As detailed in the attached criteria. Each question above is referenced in the Sub-category.

YOUR NAME: _____

EMAIL: _____ PHONE:_____

ADDRESS:_____

1. Do the 12 categories in the attached criteria address all aspects of a simulation supporting the current MDMP process at the tactical level? YES / NO

If NO, why not?

_____

_____

_____

_____

2. In the Mission Receipt category (1):

a. Do the sub-categories sufficiently address category attributes? YES / NO

If NO, why not?

_____

_____

b. Are all necessary references included? YES / NO

Should any references be added, changed, or deleted?

_____

_____

c. Do the measures and associated metrics provide a realistic evaluation tool for a simulation to support the sub-category? YES / NO

If not, how should they be changed?

_____

_____

_____

d. Could the phrasing or terminology be changed to improve the quality of the category? YES / NO If YES, make changes directly to the category.

3. In the Mission Analysis category (2):

a. Do the sub-categories sufficiently address category attributes? YES / NO

If NO, why not?

_____

_____

b. Are all necessary references included? YES / NO

Should any references be added, changed, or deleted?

_____

_____

c. Do the measures and associated metrics provide a realistic evaluation tool for a simulation to support the sub-category? YES / NO

If not, how should they be changed?

_____

_____

_____

_____

d. Could the phrasing or terminology be changed to improve the quality of the category? YES / NO If YES, make changes directly to the category.

4. In the COA Development category (3):
    a. Do the sub-categories sufficiently address category attributes? YES / NO

       If NO, why not?

       _____

       _____

    b. Are all necessary references included? YES / NO

       Should any references be added, changed, or deleted?

       _____

       _____

    c. Do the measures and associated metrics provide a realistic evaluation tool for a simulation to support the sub-category? YES / NO

       If not, how should they be changed?

       _____

       _____

       _____

       _____

    d. Could the phrasing or terminology be changed to improve the quality of the category? YES / NO If YES, make changes directly to the category.

5. In the COA Analysis category (4):
    a. Does the sub-category sufficiently address category attributes? YES / NO

       If NO, why not?

       _____

       _____

    b. Are all necessary references included? YES / NO

       Should any references be added, changed, or deleted?

       _____

       _____

    c. Do the measures and associated metrics provide a realistic evaluation tool for a simulation to support the sub-category? YES / NO

       If not, how should they be changed?

       _____

       _____

       _____

       _____

    d. Could the phrasing or terminology be changed to improve the quality of the category? YES / NO If YES, make changes directly to the category.

6. In the COA Comparison category (5):

a. Does the sub-category sufficiently address category attributes? YES / NO

If NO, why not?

_____

_____

b. Are all necessary references included? YES / NO

Should any references be added, changed, or deleted?

_____

_____

c. Does the measure and associated metric provide a realistic evaluation tool for a simulation to support the sub-category? YES / NO

If not, how should they be changed?

_____

_____

_____

_____

d. Could the phrasing or terminology be changed to improve the quality of the category? YES / NO If YES, make changes directly to the category.

7. In the COA Briefing and Approval category (6), can simulation support this category in any way other than included in category 7, Orders Production and Briefing?
YES / NO

If YES, please explain.

_____

_____

_____

_____

8. In the Orders Production and Briefing category (7):

a. Do the sub-categories sufficiently address category attributes? YES / NO

If NO, why not?

_____

_____

b. Are all necessary references included? YES / NO

Should any references be added, changed, or deleted?

_____

_____

c. Do the measures and associated metrics provide a realistic evaluation tool for a simulation to support the sub-categories? YES / NO

If not, how should they be changed?

_____

_____

d. Could the phrasing or terminology be changed to improve the quality of the category? YES / NO If YES, make changes directly to the category.

9. In the Flexibility category (8):

a. Is this category necessary for a simulation to support the MDMP? YES / NO

If NO, why not?

_____

_____

b. Are all necessary references included? YES / NO

Should any references be added, changed, or deleted?

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_____

c. Do the measures and associated metrics provide a realistic evaluation tool for a simulation to support the category? YES / NO

If not, how should they be changed?

_____

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d. Could the phrasing or terminology be changed to improve the quality of the category? YES / NO If YES, make changes directly to the category.

10. In the Interoperability category (9):

a. Is this category necessary for a simulation to support the MDMP? YES / NO

If NO, why not?

_____

_____

b. Are all necessary references included? YES / NO

Should any references be added, changed, or deleted?

_____

_____

c. Do the measures and associated metrics provide a realistic evaluation tool for a simulation to support the sub-categories? YES / NO

If not, how should they be changed?

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d. Could the phrasing or terminology be changed to improve the quality of the category? YES / NO If YES, make changes directly to the category.

11. In the Entity Behaviors category (10):

a. Is this category necessary for a simulation to support the MDMP? YES / NO

If NO, why not?

_____

_____

b. Are all necessary references included? YES / NO

Should any references be added, changed, or deleted?

_____

_____

c. Do the measures and associated metrics provide a realistic evaluation tool for a simulation to support the category? YES / NO

If not, how should they be changed?

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d. Could the phrasing or terminology be changed to improve the quality of the category? YES / NO If YES, make changes directly to the category.

12. In the Recording category (11):

a. Is this category necessary for a simulation to support the MDMP? YES / NO

If NO, why not?

_____

_____

b. Are all necessary references included? YES / NO

Should any references be added, changed, or deleted?

_____

_____

c. Do the measures and associated metrics provide a realistic evaluation tool for a simulation to support the category? YES / NO

If not, how should they be changed?

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d. Could the phrasing or terminology be changed to improve the quality of the category? YES / NO If YES, make changes directly to the category.

13. In the Decision Support category (12): Is this category necessary for a simulation to support the MDMP? YES / NO

If NO, why not?

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14. Does the attached criteria accurately reflect user functionality concerns for a simulation supporting the MDMP (not including user interface and specific hardware requirements)? YES / NO

If NO, what criteria are missing? What criteria should be removed from the list?

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APPENDIX E, INITIAL FRAMEWORK SENT TO SME

Category	Sub-Category / Question	Reference	Metric	Measure
1. Mission Receipt	Incorporates Higher Unit Graphics / 2	FM 101-5, FM 101-5-1, FBCB2 UFD	1-5; 1 = Cannot Incorporate 5 = Includes all FM 101-5-1 symbols and graphics. 2-4 scaled for % of symbols incorporated from FM 101-5-1.	"1 through 5
	Entity types / 1		Simulation Realistically models all major U.S. and threat equipment entity types and their capabilities. Including terrorist, guerrilla, and conventional threat types. Capable of introducing new types of entities.	GO/NO -GO
2. Mission Analysis	Represents the Modified Combined Obstacle Overlay (MCOO) / 3	FM 101-5, FM 34-130, FM 7-30, FM 21-26	Simulation Area of Operation (AO) scalable from 1 km2 to a minimum of 9x25 km. Area of Interest (AI) display capability.	GO/NO -GO
		FM 21-26	Simulation can represent 10 Terrain features: Cut, Fill, Hill, Saddle, Ridge, Valley, Spur, Draw, Cliff, Depression using accepted methods in FM 21-26.	GO/NO -GO
		FM 21-26, FM 5-33	Simulation models all vegetation types of Table 3-4, FM 5-33. Can represent all natural terrain surface configuration, soil features, water features, and obstacles IAW FM 5-33.	GO/NO -GO
		FM 21-26	Simulation is Military Grid Reference System (MGRS) compatible.	GO/NO -GO
		FBCB2 UFD	Simulation is DED, DTED compatible.	GO/NO -GO
		FM 90-10-1, OneSAF ORD, FM 5-33	Simulation uses verified models of urban and dynamic terrain including all man-made object types of Chapter 2, FM 5-33 and all obstacles in FM 101-5-1.	GO/NO -GO
	Represents the Modified Combined Obstacle Overlay (MCOO) / 3	ARTEP 7-30-MTP, FM 5-33, FM 34-130	Simulation represents all characteristics of the MCOO IAW "Conduct IPB" task and FM 34-130 by incorporating them from higher product or through user creation	GO/NO -GO
	Includes terrain sketch and COA sketch / modification tool / 2	FM 101-5	User can create / add / draw all above criteria, if necessary.	GO/NO -GO
	NBC / Weather analysis and modeling capabilities / 4	FM 34-130, FM 34-81-1, FM 3-6, FM 101-5	Simulation incorporates verified models of effects of all NBC agents, smoke, and weather types.	GO/NO -GO
	Graphic overlay creation tool and display methods capabilities / 2	FM 101-5, FBCB2 UFD	Simulation can distinguish /display from 0-10 overlays and can have at least 5 COAs open simulaneously. User can scale the display as desired. User can designate the Decisive Point (DP) and key terrain for the operation.	GO/NO -GO
		FM 34-130, ARTEP 7-30-MTP	User can create / display Enemy Event Templates, MCOO, SITTEMPs, doctrinal template, and event matrix. Simulation enables easy addition or deletion of graphical objects to any overlay.	GO/NO -GO
	Displays forces available (friendly and enemy) / 2	FM 101-5	Simulation allows loading of saved or doctrinal task organization. Allows easy changes to task org including support relationships.	GO/NO -GO
	Displays current situation / 2	ARTEP 7-30-MTP, FM 71.1	Simulation allows user to indicate Unit Basic Load (UBL), Controlled Supply Rates (CSRs) for supply classes I, III, IV, and V as a minimum. Also allows user to change entity supply configuration such as Armor Piercing (AP) heavy, fuel pods, rocket heavy for SEAD aircraft, etc.	GO/NO -GO
	Displays current situation / 2	ARTEP 7-30-MTP	User can assign Named Areas of Interest (NAI's) or sensors to entities by time, location, and/or type	GO/NO -GO
		FM 101-5	User can combine or separate units to task from individual to Brigade level (OPFOR division). User can "join" entities to others to conduct mounted or air movement.	GO/NO -GO
		FM 101-5, FM 3-0, ARTEP 7-30-MTP	User can assign priorities of support for units and battlefield functions to model command support relationships. This includes non-organic assets such as CAS naval gunfire, psyops, and signal.	GO/NO -GO

Note: In the initial framework, question numbers do not match the metric questions developed in section 3.3.5. Appendix I contains the correct question numbers for each sub-category as developed in section 3.3.5.

Category	Sub-Category / Question	Reference	Metric	Measure
3. COA Development	Relative Combat Power Analysis (RCPA) / 2	FM 101-5	Simulation can calculate and display firepower and protection weighted force structures analysis for friendly and enemy forces based on the friendly and enemy task organization displayed at the time..	GO/NO-GO
	Line of Sight Tool / 4	OneSAF ORD	User can display individual entity or unit fields of fire over elevation and through foliage. Range fan depiction for each weapon/unit type. User can easily change entity location during COA setup or simulation.	GO/NO-GO
	Tasking / 2	AUTL (DA PAM 11-XX)	User can task entities IAW Sections 1 through 3 of Appendix D, of the AUTL. 1 = cannot task, 5 = includes all. 2-4 based on a subjective scale to be determined later.	"1 through 5
	Tasking / 2	FM 100-5 / FM 3-0	User can assign entities 1 of 5 forms of manuever (envelopment, turning movement, penetration, infiltration, or frontal attack) or 2 patterns of defense (mobile or area) (defend in sector or defend in battle position) or one of 13 stabiliity and support operations / OOTW (see FM 3-0) or other tasks in the AUTL as specified above.	GO/NO-GO
		FM 100-5 / FM 3-0	to be achieved. User can change unit tasks by phase / time of the operation IAW the user developed synchronization matrix.	GO/NO-GO
			User can allocate SOPs to units, unit types, or entity types. User can establish global basic Rules of Engagement (ROE) for forces. User can copy routes, orders, SOP's and other Graphical Control Measures to entities.	GO/NO-GO
		ARTEP 7-30-MTP	User can associate risk with an asset by subjectively assigning criticality, vulnerability, recuperability, and threat.	GO/NO-GO
		FM 101-5	User can designate entities as Main Effort (ME) and Supporting Efforts (SE). Implications for this assignment include priority of support.	GO/NO-GO
		ARTEP 7-30-MTP	User can specify the method of employment for lift and attack aviation assets.	GO/NO-GO
		FM 101-5	User can assign headquarters to units, graphic control measures, and create an optional legend.	GO/NO-GO
	Tasking / 2	FM 101-5	User can assign Purpose, Priority (effort and support), Allocation and Restrictions to capabilities including Engineer Support, Artillery, CAS, ADA and other CS and CSS assets.	GO/NO-GO
		ARTEP 7-30-MTP	Simulation models Air Defense Artillery operations using weapons range fans, elevation, incidental coverage, terrain, graphics, and entity behaviors (including passive air defense, weapon control status, and warning status). Simulation can depict radar coverage in the area of Interest.	GO/NO-GO
		ARTEP 7-30-MTP	Simulation models Casualty Evacuation (CASEVAC) operations and resupply with verified models. Also allows bookkeeping of supply classes I, III, IV and V beginning with doctrinal levels or user input. Allows creation of CSS overlay and all other required overlays.	GO/NO-GO
		ARTEP 7-30-MTP, FM 6-20-10	Simulation accurately models targeting (of entity types) through allocation of the essential fire support tasks including the objective, formation, and function for each target, with its purpose, method, and effects. Also allows assignment of trigger points for artillery targets. User can associate trigger points with decision points, NAI's, or Targeted Areas of Interest (TAI's). User can designate entities as target observers.	GO/NO-GO

Category	Sub-Category / Question	Reference	Metric	Measure
3. COA Development (CONTINUED)	Tasking / 2	FM 100-5 / FM 3-0	User can issue Priority of fires, Time on Target, engagement criteria, and priority targets for all weapon / entity types. User can designate entity types as High Payoff Targets (HPTs).	GO/NO-GO
		FM 7-98, FM 71-1	Simulation can model air and ground resupply including service station, tailgate, and emergency resupply. This includes FAARP, LOGPAC, ROM, FLE, and Forward Support Company (FSC) operations, and Blackstar technique as a minimum for classes I, III, IV, and V..	GO/NO-GO
		ARTEP 7-30-MTP	Simulation accurately models 4 types of breaching operations, assault, in-stride, covert, and deliberate. Simulation accurately models 3 types of route clearance operations, Linear, Combat, and Combined.	GO/NO-GO
		ARTEP 7-30-MTP	User can create obstacle zones, belts, or groups with obstacle intent graphics that act as dynamic terrain in aggregated simulation. Simulation gives estimate of Class IV and time requirements based on obstacle type and dimensions.	GO/NO-GO
4. COA Analysis	War-gaming / 2	FM 101-5	Simulation enables Action / Reaction / Counteraction war-gaming.	GO/NO-GO
		FM 101-5	Simulation uses a method for recording the war game.	GO/NO-GO
4. COA Analysis (CONTINUED)	War-gaming / 2	FM 101-5	Simulation allows unlimited user-defined branch and sequel analysis including contingencies, reserve operations, and other decision dependent situations User can specify abort criteria for units and tasks.	GO/NO-GO
			Simulation uses verified movement and attrition models for direct and indirect (and EW) weapons including fratricide for each entity type. Simulation adequately models all current munition types and their effects. Also allows addition of munition types.	GO/NO-GO
		ARTEP 7-30-MTP	Simulation accurately models Mobility (SOSR), Countermobility (effects), and Survivability operations and fortifications using dynamic terrain, graphics, and entity behaviors.	GO/NO-GO
			Simulation models signals used for communication such as star clusters.	
		FM 101-5	Simulation allows war-gaming by belt, box, and avenue methods	GO/NO-GO
		ARTEP 7-30-MTP	Simulation facilitates creation of the Decision Support Template (DST), Target Synchronization Matrix, Fire Support Execution Matrix (FSEM), Target List Worksheet, and Execution Matrix and other decision support tools.	GO/NO-GO
5. COA Comparison	2	FM 101-5	Simulation provides standard criteria for COA comparison with adequate estimates of criteria such as supply (class I, III, IV, V) consumption, casualties, relative risk, mass, etc for each COA.	GO/NO-GO
6. COA Briefing and Approval	See orders production and briefing			
7. Orders Production and Briefing	Electronic Distribution / 2	FBCB2 UFD	Simulation allows saving and export of all war-game executions.	GO/NO-GO
		FBCB2 UFD	Simulation allows saving, export, and printing (to scale or as user determined) of all overlays and graphics.	GO/NO-GO
	Briefing / 2	OneSAF ORD	Simulation allows rapid COA replay.	GO/NO-GO
		OneSAF ORD	Simulation allows voice capture.	GO/NO-GO

Category	Sub-Category / Question	Reference	Metric	Measure
8. Flexibility	4	OneSAF ORD, Barone & Roberts, Garrabrants &Blais, Surdu	Simulation is real-time and much faster than real time capable. (Time compression of at least 9:1).	GO/NO-GO
		OneSAF ORD, Barone & Roberts, Garrabrants &Blais, Surdu	User can easily execute a COA simulation using any combination of overlays for contingency analysis. Simulation is interruptible and changeable (entity locations and tasks, etc.) while the COA is executing.	GO/NO-GO
		OneSAF ORD	The simulation can model up to 10 sides / factions including civilians and Non-Governmental Organizations (NGO's).	GO/NO-GO
	4		Simulation is executable on as many Operating Systems as determined feasible by the responsible agency.	GO/NO-GO
			Simulation enables quick (< 1 minute) loading of COAs.	GO/NO-GO
9. Interoperability	Standards	AR 5-11	Simulation is High Level Architecture (HLA) Compliant.	GO/NO-GO
		AR 5-11	Simulation complies with DOD Technical Architecture Framework for Information Management (TAFIM).	GO/NO-GO
		AR 5-11	Simulation is compatible with the Joint Technical Architecture (JTA).	GO/NO-GO
	Collaborative Planning 2 / 4	JMACE experiment, FBCB2 UFD	Simulation is Distributed and Interactive with messaging, real time drawing, commander synchronization control, and MDMP timeline capabilities.	GO/NO-GO
	Run Time modes / 4	OneSAF ORD	Simulation can run in stand-alone, linked, or networked modes	GO/NO-GO
10. Entity Behaviors	1	OneSAF ORD	Simulation can fully automate entity behaviors during war-game simulations, including battlefield congestion.	GO/NO-GO
			Simulation uses a verified model for unit communications.	GO/NO-GO
		OneSAF ORD	CGF entities recognize graphics (All of FM 101-5-1) including boundaries, control and coordination measures, TRPs, NAI's, objectives, and obstacles and behave accordingly at them.	GO/NO-GO
		OneSAF ORD	CGF entities experience behavioral degradation from the effects of terrain, weather, and operations.	GO/NO-GO
		OneSAF ORD	Entities behave appropriately on all types of terrain, trafficability, vegetation, and features.	GO/NO-GO
11. Recording	4	OneSAF ORD	Simulation allows saving of multiple COA war-game iterations for each mission.	GO/NO-GO
	Logging Capability / 4	OneSAF ORD	Simulation can record and store COA run data including time, entity location, action, and results in a user-friendly database.	GO/NO-GO
	Logging Capability / 4		Simulation records/estimates COA personnel and equipment losses with supply status usage.	GO/NO-GO
12. Decision Support	Not addressed in this research			

APPENDIX F, SUMMARY OF SME SURVEY COMMENTS

LTC Domitrovich:

1. LTC Domitrovich stated that the framework must include the ability for a commander to add to, change, or delete COA comparison / evaluation criteria. **Added to metric in category 4.**
2. LTC Domitrovich requires the addition of a Troop-Leading Procedures (TLP) reference and simulation tool to allow for better tracking of the available planning time. **Addressed in category 9. Moved requirements to new category (13).**
3. LTC Domitrovich affirmed the need for simulation flexibility and entity behaviors.

MAJ Surdu:

1. MAJ Surdu commented that the framework must include the ability to support collaborative rehearsals and After-Action Reviews. He stated that this must be included as an additional category. **Added category (13), Collaborative Planning.** He said that the interoperability and entity behaviors categories are not necessary for a simulation to support the MDMP. **No action. Discussed in chapter 3.**
2. MAJ Surdu stated that a simulation supporting the MDMP should also incorporate Vector Product Format (VPF) terrain. **Added VPF Terrain to metric in category 2.** He also affirmed the need for dynamic terrain representation including missing bridges, craters, and flooding. **Added to metric in category 2.**
3. MAJ Surdu requires that the simulation model entity behavioral attributes including training, morale, cohesion, leadership, and communications. **Addressed in chapter 3—include as long as additional behavior characteristics do not degrade COA Analysis performance.**
4. MAJ Surdu confirmed the need to designate entities as main effort and supporting efforts, assign them routes or axes of advance, and priority of fires. He implied that additional entity tasking should be done by exception to keep the simulation from being too slow. **Further research.**

5. MAJ Surdu stated the framework should not include a Line-of-Sight tool. **No action. No SME consensus.**
6. MAJ Surdu commented that the Action-Reaction-Counteraction paradigm is insufficient as a COA analysis technique. **Further research.**
7. MAJ Surdu requires that COL Trevor Dupuy's *Attrition* be included as a reference under COA analysis. He also stated that civilian war-games and war-gaming books are applicable. **No action.** MAJ Surdu suggested that attrition modeling include soft factors such as morale, cohesion, and leadership. **No Action. Validation issue for further research.**
8. MAJ Surdu confirmed that commanders must be able to change the COA Evaluation criteria. He is concerned about how added, subjective criteria would be weighted. **Changed metric in category 4.**
9. MAJ Surdu suggested that unit Standard Operating Procedures (SOP) will help define criteria for Orders Production and Briefing. **No action. No doctrinal reference available.**
10. MAJ Surdu requested clarification on voice capture as part of the Orders Production and Briefing category. **Added to metric in category 7.**
11. MAJ Surdu expressed concern that the detail required in COAs will make it very difficult to load them in less than a minute. **Clarified metric in category 8.**
12. MAJ Surdu wrote that the interoperability category needed to be clarified and expanded to include target applications. **No action. May restrict future application of the framework. Interoperability governed by AR 5-11.**
13. MAJ Surdu requires that a simulation supporting the MDMP have simply defined entity behaviors. This enables realistic comparison of COAs. **Further Research.**
14. MAJ Surdu inquired if AAR references from NTC were applicable to the framework. **No action. Addressed in chapter 1.**
15. MAJ Surdu affirmed the need for decision support capabilities for a simulation supporting the MDMP. **No action.**

16. MAJ Surdu was concerned that some areas of the framework criteria were too detailed to support the MDMP. **No action. This is a critical issue for further research. As discussed in chapter 3, capabilities must be balanced against performance.**

Mr. Eric Johnson:

1. Mr. Johnson suggested that the textual parts of the OPORD be included in the framework. **Added sub-category "Text-based products" to category 7.**
2. Mr. Johnson stated that the metrics throughout the framework need more scalability. **Changed appropriate measures to reflect 0-100% complete.**
3. Mr. Johnson requires clarification of maneuver unit support priority and tasks to CS and CSS units priority of effort. **No action. The distinction is between priority of effort for capabilities and priority of support based on unit mission.**
4. Mr. Johnson suggested that a simulation supporting the MDMP must allow printing of the Execution Matrix. **Added to metric in category 7.**
5. Mr. Johnson expressed that the Flexibility category is extremely important for end-user functionality. **No action.**
6. Mr. Johnson asserted that the COA Analysis/Replay capabilities must allow at least a 60:1 time compression ratio. **Discussed in chapter 3. Further research.**
7. Mr. Johnson stated that a simulation supporting the MDMP should be PC-based. **No action. Hardware issues are not addressed in this research. PC requirement may restrict future application of the framework.**

LTC Wilmer:

1. LTC Wilmer stated that Collaborative planning should be added as a major category. **Added major category 13.**
2. LTC Wilmer suggested the text tools for OPORD production be included in the framework. **Added sub-category "Text-based products" to category 7.**

3. LTC Wilmer suggested more scalability in all metrics based on a study of user needs. **Changed appropriate measures to reflect 0-100% complete.**
4. LTC Wilmer stated that the framework should detail the systems to be supported by name (FBCB2, MCS, etc.). **No action. May restrict future application of the framework. Interoperability governed by AR 5-11.**
5. LTC Wilmer questioned the necessity for detailed weather modeling in a simulation supporting the MDMP. **Addressed in chapter 3—include as long as additional modeling characteristics do not degrade COA Analysis performance.**
6. LTC Wilmer expressed concern that the detail required in the framework (particularly in the COA development category) might limit the performance of the system. **No action. As discussed in chapter 3, capabilities must be balanced against performance.**
7. LTC Wilmer suggested COA development include the ability to create and manipulate COAs or parts of COAs. **Added to metric in category 4.**
8. LTC Wilmer suggested adding COA development steps to the COA development category. **Added four sub-categories to category 3 and changed two other sub categories to reflect the steps of COA development more clearly.**
9. LTC Wilmer stated that the method of recording the war-game should be explicit in the frame-work. **Added to metric in category 4.**
10. LTC Wilmer suggested adding formatted briefing templates to category 6 for increased briefing flexibility. **No action. Reference not available.**
11. LTC Wilmer questioned the maximum number of 10 sides to model in the simulation. **Further research. No SME consensus.**
12. LTC Wilmer questioned the need to have the simulation support different Operating Systems. **Further research.**
13. LTC Wilmer stated that the Entity Behaviors category was unnecessary for modeling operations above the company level. **No Action. Discussed in chapter 3.**

LTC Riese:

1. LTC Riese stated that measures for all criteria must be reexamined. He implied they are not flexible enough. He suggested changing the measures for each category. **Changed appropriate measures to reflect 0-100% complete.**
2. LTC Riese suggested adding Commander's Guidance as a major category in the framework. **Added category 14.**
3. LTC Riese suggested incorporating higher-level commander's intent into a simulation supporting the MDMP. **Added to metric in category 1.**
4. LTC Riese questioned the need for a simulation to represent the 10 terrain feature types. **No action. No SME consensus.**
5. LTC Riese stated the framework must include commander's planning guidance. **Added category 14.**
6. LTC Riese questioned the necessity for the simulation to include battle drills (such as methods of breaching). **Further research.**
7. LTC Riese suggested the inclusion of staff estimates in the simulation. **No action. As discussed in chapter 3, capabilities must be balanced against performance.**
8. LTC Riese suggested listing all COA comparison criteria in the framework. **Added metric to category 4.**
9. LTC Riese stated that a simulation supporting the MDMP must allow for rapid change/piecing of COAs. **Added to metric in category 4.**
10. LTC Riese asserted that FM 101-5 be included as a reference for the Orders Production and Briefing category. **Added sub-category to category 7.**
11. LTC Riese requested clarification on "voice capture" in category 7. **Clarified metric in category 7.**
12. LTC Riese suggested that a 9:1 time compression was insufficient to support COA analysis. **Further research.** He also stated that the user should be able to skip parts of a briefing replay. **Added to metric in category 7.**
13. LTC Riese stated that modeling of 10 sides in a COA may be insufficient. **Further research. No SME consensus.**

14. LTC Riese questioned the need for the simulation to be HLA compliant. **No Action. AR 5-11 requirement.**
15. LTC Riese suggested that the interoperability category include collaborative planning aimed at improving concurrent/simultaneous subordinate planning. **Added sub-category to category 13.**
16. LTC Riese suggested examining other references for entity behavior criteria. **Further research.**
17. LTC Riese questioned the ability to verify a model of unit communications. **Further research.**
18. LTC Riese stated the framework must include the ability to quickly change enemy COAs. **No action. Enemy COAs are a type of overlay for framework purposes.**
19. LTC Riese asserted that a simulation supporting the MDMP must allow for AAR and post-mortem analysis. **Added additional category (13), Collaborative Planning.**

LTC Lee:

1. LTC Lee suggests the incorporation of text-based tools for input and output of OPORD products--particularly for tracking commander's guidance in each category. **Added category 13 and 14.**
2. LTC Lee states that more CSS functions/roles need to be included in the framework such as maintenance, personnel system functions, and civil affairs. **Further research.**
3. LTC Lee comments that adding plan tracking (decision support) capabilities including MDMP timelines, planning time remaining, and product reminders (such as warning order publishing) would greatly enhance a simulation supporting the MDMP. **MDMP timeline capability moved to category 13. Decision support not addressed in this research.**
4. LTC Lee suggests that most of the best references for developing planning are located in custom sources, such as professional schools and unit SOPs. **Further research.**
5. LTC Lee states that FM 3-0 accounts for 25 SASO tasks, not 13 as incorporated in the framework. **Changed metric in category 3.**

6. LTC Lee points out potential difficulties with assigning SOPs to entity types. **Further research.**
7. LTC Lee requires a simulation in support of the MDMP to support risk assessment in close, deep, and rear operations (both offensive and defensive). **Added to metric in category 3.**
8. LTC Lee suggests the framework support decisions by notifying the user when plan conflicts with stored objectives / overlays. **No Action. Decision support is not addressed in this research.**

Mr. Greg Schow (This interview was conducted in person)

1. Mr. Schow made no specific comments on the framework. His general comments are indicated here. Mr. Schow felt that the framework provides a good basis for further research but that it is generally insufficient for use in developing a simulation to support the MDMP. **No Action. No SME consensus.**
2. Mr. Schow indicated that the current MDMP may not be sufficient for future operations. He stated that the framework probably does not cover everything. **No Action. No SME consensus.**
3. Mr. Schow implied that the framework was insufficient to use in a field environment. **No Action. No SME consensus.**
4. Mr. Schow implied that the goal in using appropriate references is not to find all but the most sufficient ones for each case. **Further research.**
5. Mr. Schow commented that the measures must account for, “How well does a simulation support each area of the MDMP?” (as opposed to, “Does it support the MDMP?”). **Changed appropriate measures to reflect 0-100% complete.**
6. Mr. Schow stated that the best way a simulation can support the MDMP is through combining COA Development, COA Analysis, and COA Comparison and Selection into one step. He further asserted that the output of this simulation would be the COA Briefing. **Further research. No SME consensus.**
7. Mr. Schow suggested that the metrics are insufficient since they are not defined. **Further research. No SME consensus.**

APPENDIX G: SUB-CATEGORY RESULTS

Category 1: Mission Receipt

Sub-Category	Metric	Agreement	Add	Change	Delete	Neutral	Further Research
Incorporates Higher Unit Graphics	1-5; 1 = Cannot Incorporate 5 = Includes all FM 101-5-1 symbols and graphics. 2-4 scaled for % of symbols incorporated from FM 101-5-1.	◎	4	1		2	
Entity types	Simulation Realistically models all major U.S. and threat equipment entity types and their capabilities. Including terrorist, guerrilla, and conventional threat types. Capable of introducing new types of entities.	◎◎◎◎		1			

Category 2: Mission Analysis

Sub-Category	Metric	Agreement	Add	Change	Delete	Neutral	Further Research
Represents the Modified Combined Obstacle Overlay (MCOO)	Simulation Area of Operation (AO) scalable from 1 km2 to a minimum of 9x25 km Area of Interest (AI) display capability.	○○○○○					
	Simulation can represent 10 Terrain features: Cut, Fill, Hill, Saddle, Ridge, Valley, Spur, Draw, Cliff, Depression using accepted methods in FM 21-26.	○○○○○				1	
	Simulation models all vegetation types of Table 3-4, FM 5-33. Can represent all natural terrain surface configuration, soil features, water features, and obstacles IAW FM 5-33.	○○○○		1			
	Simulation is Military Grid Reference System (MGRS) compatible.	○○○○○					
	Simulation is DED, DTED compatible.	○○○○	1				
	Simulation uses verified models of urban and dynamic terrain including all man-made object types of Chapter 2, FM 5-33 and all obstacles in FM 101-5-1.	○○○○	1				
Represents the Modified Combined Obstacle Overlay (MCOO)	Simulation represents all characteristics of the MCOO IAW "Conduct IPB" task and FM 34-130 by incorporating them from higher product or through user creation	○○○	1	1			
Includes terrain sketch and COA sketch / modification tool	User can create / add / draw all above criteria, if necessary.	○○○○○					
NBC / Weather analysis and modeling capabilities	Simulation incorporates verified models of effects of all NBC agents, smoke, and weather types.	○○○○				1	

Category 2: Mission Analysis (Continued)

Sub-Category	Metric	Agreement	Add	Change	Delete	Neutral	Further Research
Graphic overlay creation tool and display methods capabilities	Simulation can distinguish /display from 0-10 overlays and can have at least 5 COAs open simultaneously. User can scale the display as desired. User can designate the Decisive Point (DP) and key terrain for the operation.	○○○○○					
	User can create / display Enemy Event Templates, MCOO, SITTEMPs, doctrinal template, and event matrix. Simulation enables easy addition or deletion of graphical objects to any overlay.	○○○	1	1			
Displays forces available (friendly and enemy)	Simulation allows loading of saved or doctrinal task organization. Allows easy changes to task org including support relationships.	○○○○○					
Displays current situation	Simulation allows user to indicate Unit Basic Load (UBL), Controlled Supply Rates (CSRs)for supply classes I, III, IV, and V as a minimum. Also allows user to change entity supply configuration such as Armor Piercing (AP) heavy, fuel pods, or rocket Heavy for SEAD aircraft, etc.	○○○○		1			
	User can assign Named Areas of Interest (NAI's) or sensors to entities by time, location, and/or type	○○○○○					
	User can combine or separate units to task from individual to Brigade level (OPFOR division). User can "join" entities to others to conduct mounted or air movement.	○○○○○					
	User can assign priorities of support for units and battlefield functions to model command support relationships. This includes non-organic assets such as CAS naval gunfire, psyops, and signal.	○○○○○					

Category 3: COA Development

Sub-Category	Metric	Agreement	Add	Change	Delete	Neutral	Further Research
Relative Combat Power Analysis (RCPA)	Simulation can calculate and display firepower and protection weighted force structures analysis for friendly and enemy forces based on the friendly and enemy task organization displayed at the time..	4	1				
Line of Sight Tool	User can display individual entity or unit fields of fire over elevation and through foliage. Range fan depiction for each weapon/unit type. User can easily change entity location during COA setup or simulation.	4			1		
Tasking	User can task entities IAW Sections 1 through 3 of Appendix D, of the AUTL. 1 = cannot task, 5 = includes all. 2-4 based on a subjective scale to be determined later.	5					
	User can assign entities 1 of 5 forms of maneuver (envelopment, turning movement, penetration, infiltration, or frontal attack) or 2 patterns of defense (mobile or area) (defend in sector or defend in battle position) or one of 13 stability and support operations / OOTW (See FM 3-0) or other tasks in the AUTL as specified above.	4	1				
	User can specify degree of success for each task to be achieved. User can change unit tasks by phase / time of the operation IAW the user developed synchronization matrix	5					

Category 3: COA Development (Continued)

Sub-Category	Metric	Agreement	Add	Change	Delete	Neutral	Further Research
Tasking	User can allocate SOPs to units, unit types, or entity types. User can establish global basic Rules of Engagement (ROE) for forces. User can copy routes, orders, SOPs and other Graphical Control Measures to entities.	○○○○		1			
	User can associate risk with an asset by subjectively assigning criticality, vulnerability, recuperability, and threat.	○○○○	1				
	User can designate entities as Main Effort (ME) and Supporting Efforts (SE). Implications for this assignment include priority of support.	○○○○		1			
	User can specify the method of employment for lift and attack aviation assets.	○○○○○					
	User can assign headquarters to units, graphic control measures, and create an optional legend.	○○○○○					
	User can assign Purpose, Priority (effort and support), Allocation and Restrictions to capabilities including Engineer Support, Artillery, CAS, ADA and other CS and CSS assets.	○○○○○					
	Simulation models Air Defense Artillery operations using weapons range fans, elevation, incidental coverage, terrain, graphics, and entity behaviors (including passive air defense, weapon control status, and warning status). Simulation can depict radar coverage in the AI.	○○○○○					
	Simulation models Casualty Evacuation (CASEVAC) operations and resupply with verified models. Also allows bookkeeping of supply classes I, III, IV and V beginning with doctrinal levels or user input. Allows creation of CSS overlay and all other required overlays.	○○○	1			1	

Category 3: COA Development (Continued)

Sub-Category	Metric	Agreement	Add	Change	Delete	Neutral	Further Research
Tasking	Simulation accurately models targeting (of entity types) through allocation of the essential fire support tasks including the objective, formation, and function for each target, with its purpose, method, and effects. Also allows assignment of trigger points for artillery targets. User can designate entities as target observers.	●●●●				1	
	User can issue Priority of fires, Time on Target, engagement criteria, and priority targets for all weapon / entity types. User can designate entity types as High Payoff Targets (HPTs).	●●●●●					
	Simulation can model air and ground resupply including service station, tailgate, and emergency resupply. This includes FAARP, LOGPAC, ROM, FLE, and Forward Support Company (FSC) operations, and Blackstar technique as a minimum for classes I, III, IV, and V.	●●●●●					
	Simulation accurately models 4 types of breaching operations, assault, in-stride, covert, and deliberate. Simulation accurately models 3 types of route clearance operations, Linear, Combat, and Combined.	●●●●				1	
	User can create obstacle zones, belts, or groups with obstacle intent graphics that act as dynamic terrain in aggregated simulation. Simulation gives estimate of Class IV and time requirements based on obstacle type and dimensions.	●●●●●					

Category 4: COA Analysis

Sub-Category	Metric	Agreement	Add	Change	Delete	Neutral	Further Research
War-gaming	Simulation enables Action / Reaction / Counteraction war-gaming.	●●●●	1				
	Simulation uses a method for recording the war game.	●●●●		1			
	Simulation allows unlimited user-defined branch and sequel analysis including contingencies, reserve operations, and other decision dependent situations User can specify abort criteria for units and tasks.	●●	1	2			
	Simulation uses verified movement and attrition models for direct and indirect (and EW) weapons including fratricide for each entity type. Simulation adequately models all current munition types and their effects. Also allows addition of munition types.	●●●●	1				
	Simulation accurately models Mobility (SOSR), Countermobility (effects), and Survivability operations and fortifications using dynamic terrain, graphics, and entity behaviors.	●●●●●					
	Simulation models signals used for communication such as star clusters.	●●●			2		
	Simulation allows war-gaming by belt, box, and avenue methods	●●●●●					
	Simulation facilitates creation of the Decision Support Template (DST), Target Synchronization Matrix, Fire Support Execution Matrix(FSEM), Target List Worksheet, and Execution Matrix and other decision support tools.	●●●●●					

Category 5: COA Comparison

Sub-Category	Metric	Agreement	Add	Change	Delete	Neutral	Further Research
	Simulation provides standard criteria for COA comparison with adequate estimates of criteria such as supply (class I, III, IV, V) consumption, casualties, relative risk, mass, etc for each COA.	●	2	2			

Category 6: COA Briefing and Approval

Sub-Category	Metric	Agreement	Add	Change	Delete	Neutral	Further Research
		●●●●	1				

Category 7: Orders Production and Briefing

Sub-Category	Metric	Agreement	Add	Change	Delete	Neutral	Further Research
Electronic Distribution	Simulation allows saving and export of all war-game executions.	●●●●●					
	Simulation allows saving, export, and printing (to scale or as user determined) of all overlays and graphics.	●●●●		1			
Briefing	Simulation allows rapid COA replay.	●●●●●					
	Simulation allows voice capture.	●●●		2			

Category 8: Flexibility

Sub-Category	Metric	Agreement	Add	Change	Delete	Neutral	Further Research
	Simulation is real-time and much faster than real time capable. (Time compression of at least 9:1).	●●●		2			
	User can easily execute a COA simulation using any combination of overlays for contingency analysis. Simulation is interruptible and changeable (entity locations and tasks, etc.) while the COA is executing.	●●●●	1				
	The simulation can model up to 10 sides / factions including civilians and Non-Governmental Organizations (NGO's).	●●●●		1			1
	Simulation is executable on as many Operating Systems as determined feasible by the responsible agency.	●●●		2			
	Simulation enables quick (< 1 minute) loading of COAs.	●●●●		1			

Category 9: Interoperability

Sub-Category	Metric	Agreement	Add	Change	Delete	Neutral	Further Research
Standards	Simulation is High Level Architecture (HLA) Compliant.	⚪⚪⚪		1		1	
	Simulation complies with DOD Technical Architecture Framework for Information Management (TAFIM).	⚪⚪⚪				1	
	Simulation is compatible with the Joint Technical Architecture (JTA).	⚪⚪⚪				1	
Collaborative Planning	Simulation is Distributed and Interactive with messaging, real time drawing, commander synchronization control, and MDMP timeline capabilities.	⚪⚪⚪⚪					
Run Time modes	Simulation can run in stand-alone, linked, or networked modes	⚪⚪⚪				1	

Category 10: Entity Behaviors

Sub-Category	Metric	Agreement	Add	Change	Delete	Neutral	Further Research
	Simulation can fully automate entity behaviors during war-game simulations, including battlefield congestion.						
	Simulation uses a verified model for unit communications.					1	
	CGF entities recognize graphics (All of FM 101-5-1) including boundaries, control and coordination measures, TRPs, NAI's, objectives, and obstacles and behave accordingly at them						
	CGF entities experience behavioral degradation from the effects of terrain, weather, and operations.						
	Entities behave appropriately on all types of terrain, trafficability, vegetation, and features.						

Category 11: Recording

Sub-Category	Metric	Agreement	Add	Change	Delete	Neutral	Further Research
	Simulation allows saving of multiple COA war-game iterations for each mission.	○○○○○					
Logging Capability	Simulation can record and store COA run data including time, entity location, action, and results in a user-friendly database.	○○○○○					
Logging Capability	Simulation records/estimates COA personnel and equipment losses with supply status usage.	○○○○○					

APPENDIX H, SME SURVEYS

Part 1: LTC Domitrovich

1. Do the 12 categories in the attached criteria address all aspects of a simulation supporting the current MDMP process at the tactical level? NO

If NO, why not?

__#5 DOES NOT ALLOW FOR ADDITION OF OTHER CRITERIA AS THE COMMANDER MAY DESIRE AS EVALUATION CRITERIA_____
_____

2. In the Mission Receipt category (1):

c. Do the sub-categories sufficiently address category attributes? YES /
If NO, why not?

_____

_____

d. Are all necessary references included? / NO

Should any references be added, changed, or deleted?

__ADD TLP SO YOU CAN DO TIME CONSTRAINED EXERCISES

c. Do the measures and associated metrics provide a realistic evaluation tool for a simulation to support the sub-category? YES /

If not, how should they be changed?

_____

_____

_____

_____

e. Could the phrasing or terminology be changed to improve the quality of the category? NO If YES, make changes directly to the category.

3. In the Mission Analysis category (2):

c. Do the sub-categories sufficiently address category attributes? YES /
If NO, why not?

_____

d. Are all necessary references included? YES /

Should any references be added, changed, or deleted?

_____

_____

c. Do the measures and associated metrics provide a realistic evaluation tool for a simulation to support the sub-category? YES /
If not, how should they be changed?

_____

_____

_____

_____

d. Could the phrasing or terminology be changed to improve the quality of the category? NO If YES, make changes directly to the category.

4. In the COA Development category (3):

a. Do the sub-categories sufficiently address category attributes? YES
If NO, why not?

_____

_____

b. Are all necessary references included?

Should any references be added, changed, or deleted?

SEE NOT ABOVE REF TLP

c. Do the measures and associated metrics provide a realistic evaluation tool for a simulation to support the sub-category? YES

If not, how should they be changed?

_____

_____

_____

_____

d. Could the phrasing or terminology be changed to improve the quality of the category? / NO If YES, make changes directly to the category.

5. In the COA Analysis category (4):

a. Does the sub-category sufficiently address category attributes? YES

If NO, why not?
ADD THE ABILITY TO ADD ADDITIONAL CRITERIA OR DELETE UNDESIRED CRITERIA

b. Are all necessary references included? YES

Should any references be added, changed, or deleted?

_____

_____

c. Do the measures and associated metrics provide a realistic evaluation tool for a simulation to support the sub-category? YES

If not, how should they be changed?

_____

_____

_____

_____

d. Could the phrasing or terminology be changed to improve the quality of the category? NO If YES, make changes directly to the category.

6. In the COA Comparison category (5):

a. Does the sub-category sufficiently address category attributes? NO

If NO, why not?

SEE NOTE ABOVE IN PRIOR CATAGORY

b. Are all necessary references included? YES

Should any references be added, changed, or deleted?

_____

_____

c. Does the measure and associated metric provide a realistic evaluation tool for a simulation to support the sub-category? YES /

If not, how should they be changed?

_____

_____

_____

d. Could the phrasing or terminology be changed to improve the quality of the category? / NO If YES, make changes directly to the category.

7. In the COA Briefing and Approval category (6), can simulation support this category in any way other than included in category 7, Orders Production and Briefing?
NO

If YES, please explain.

_____

_____

_____

_____

8. In the Orders Production and Briefing category (7):

a. Do the sub-categories sufficiently address category attributes? YES

If NO, why not?

_____

_____

b. Are all necessary references included? YES

Should any references be added, changed, or deleted?

_____

_____

c. Do the measures and associated metrics provide a realistic evaluation tool for a simulation to support the sub-categories? YES
If not, how should they be changed?

_____

d. Could the phrasing or terminology be changed to improve the quality of the category? / NO If YES, make changes directly to the category.

9. In the Flexibility category (8):
   a. Is this category necessary for a simulation to support the MDMP? YES / If NO, why not?

      THIS IS PROBABLY ONE OF THE BETTER SECTIONS TO ALLOW THE USER TO GET WHAT HE NEEDS

   b. Are all necessary references included? YES

      Should any references be added, changed, or deleted?

      _____

      _____

   c. Do the measures and associated metrics provide a realistic evaluation tool for a simulation to support the category? YES

      If not, how should they be changed?

      _____

      _____

      _____

      _____

   d. Could the phrasing or terminology be changed to improve the quality of the category? / NO If YES, make changes directly to the category.

10. In the Interoperability category (9):
    a. Is this category necessary for a simulation to support the MDMP? YES / If NO, why not?

       _____

       _____

b. Are all necessary references included? YES
Should any references be added, changed, or deleted?

_____

_____

c. Do the measures and associated metrics provide a realistic evaluation tool for a simulation to support the sub-categories? YES /

If not, how should they be changed?

_____

_____

_____

_____

d. Could the phrasing or terminology be changed to improve the quality of the category? / NO If YES, make changes directly to the category.

11. In the Entity Behaviors category (10):
    a. Is this category necessary for a simulation to support the MDMP? YES /
    If NO, why not?
    GOOD ADDITION ATTRIBUTES HERE

    b. Are all necessary references included? YES /

    Should any references be added, changed, or deleted?

    _____

    _____

c. Do the measures and associated metrics provide a realistic evaluation tool for a simulation to support the category? YES /

If not, how should they be changed?

_____

_____

_____

_____

d. Could the phrasing or terminology be changed to improve the quality of the category? / NO If YES, make changes directly to the category.

12. In the Recording category (11):

a. Is this category necessary for a simulation to support the MDMP? YES / If NO, why not?

_____

_____

b. Are all necessary references included? YES /
Should any references be added, changed, or deleted?

_____

_____

c. Do the measures and associated metrics provide a realistic evaluation tool for a simulation to support the category? YES /

If not, how should they be changed?

_____

_____

d. Could the phrasing or terminology be changed to improve the quality of the category? / NO If YES, make changes directly to the category.

13. In the Decision Support category (12): Is this category necessary for a simulation to support the MDMP? YES

If NO, why not?

_____

_____

_____

_____

14. Does the attached criteria accurately reflect user functionality concerns for a simulation supporting the MDMP (not including user interface and specific hardware requirements)? YES /

If NO, what criteria are missing? What criteria should be removed from the list?

_____

_____

_____

_____

_____

Part 2: MAJ Surdu

1. Do the 12 categories in the attached criteria address all aspects of a simulation supporting the current MDMP process at the tactical level? YES / (NO)

   If NO, why not?

   Needs to also support rehearsals (some of the need capabilities are included in other categories)

   Needs to support AARs and post-mortem what ifs — even DURING REAL WAR

2. In the Mission Receipt category (1):
   a. Do the sub-categories sufficiently address category attributes? (YES) / NO

      If NO, why not?

   b. Are all necessary references included? YES / NO

      Should any references be added, changed, or deleted?

      Yes.

   c. Do the measures and associated metrics provide a realistic evaluation tool for a simulation to support the sub-category? (YES) / NO

      If not, how should they be changed?

   d. Could the phrasing or terminology be changed to improve the quality of the category? YES / (NO) If YES, make changes directly to the category.

1

3. In the Mission Analysis category (2):
   a. Do the sub-categories sufficiently address category attributes? YES / NO

      If NO, why not?

      Should VPF terrain be supported

      The system should be able to track terrain changes (e.g. bridges (M), big craters, flooding, etc.)

   b. Are all necessary references included? YES / NO

      Should any references be added, changed, or deleted?

      See notes in App. B. I think, in general you are trying to include too much detail

   c. Do the measures and associated metrics provide a realistic evaluation tool for a simulation to support the sub-category? YES / NO

      If not, how should they be changed?

   d. Could the phrasing or terminology be changed to improve the quality of the category? YES / NO If YES, make changes directly to the category.

4. In the COA Development category (3):
   a. Do the sub-categories sufficiently address category attributes? YES / NO

      If NO, why not?

      - RCPA is not sufficient. We need to include "hard" stuff like training, morale, cohesion, leadership, comms, ...

      - Under LOS — too much detail. Don't need so much of that range-fan stuff

      - Designate M.E., follow-on & spt, supporting effort, priority of fires, axes, etc. That is enough.

b. Are all necessary references included? YES / NO

Should any references be added, changed, or deleted?

_____

_____

c. Do the measures and associated metrics provide a realistic evaluation tool for a simulation to support the sub-category? YES / NO

If not, how should they be changed?

_____

_____

_____

_____

d. Could the phrasing or terminology be changed to improve the quality of the category? YES / NO If YES, make changes directly to the category.

5. In the COA Analysis category (4):

a. Does the sub-category sufficiently address category attributes? YES / NO

If NO, why not?

The gaming methods listed are necessary simplifications in the analog world. Action/reaction/counteraction is sufficient to stay inside the enemy's decision cycle

Verified attrition models are necessary but not sufficient. See notes.

b. Are all necessary references included? YES / NO

Should any references be added, changed, or deleted?

Civilian wargames & wargames books.

Dupuy "Attrition"

For part 5, the criteria used should be tailorable by the commander from a set of options (menus).

c. Do the measures and associated metrics provide a realistic evaluation tool for a simulation to support the sub-category? YES / NO

If not, how should they be changed?

d. Could the phrasing or terminology be changed to improve the quality of the category? YES / NO If YES, make changes directly to the category.

6. In the COA Comparison category (5):

a. Does the sub-category sufficiently address category attributes? YES / NO

If NO, why not?

Criteria should be tailorable to CDR / situation by selection metrics from some lists

b. Are all necessary references included? YES / NO

Should any references be added, changed, or deleted?

c. Does the measure and associated metric provide a realistic evaluation tool for a simulation to support the sub-category? YES / NO

If not, how should they be changed?

What metrics will be allowed? What are the "standard criteria?"

d. Could the phrasing or terminology be changed to improve the quality of the category? YES / NO If YES, make changes directly to the category.

7. In the COA Briefing and Approval category (6), can simulation support this category in any way other than included in category 7, Orders Production and Briefing?
YES / NO No

If YES, please explain.

8. In the Orders Production and Briefing category (7):
   a. Do the sub-categories sufficiently address category attributes? YES / NO

      If NO, why not?

   b. Are all necessary references included? YES / NO

      Should any references be added, changed, or deleted?

      There must be some SOPs at Ft. Hood that should be cited

   c. Do the measures and associated metrics provide a realistic evaluation tool for a simulation to support the sub-categories? YES / NO

      If not, how should they be changed?

d. Could the phrasing or terminology be changed to improve the quality of the category? YES / NO If YES, make changes directly to the category.

9. In the Flexibility category (8):

a. Is this category necessary for a simulation to support the MDMP? YES / NO

If NO, why not?

In particular load a COA in less than a minute. How do you do this and also retain all the detail from previous sections?

b. Are all necessary references included? YES / NO

Should any references be added, changed, or deleted?

c. Do the measures and associated metrics provide a realistic evaluation tool for a simulation to support the category? YES / NO

If not, how should they be changed?

d. Could the phrasing or terminology be changed to improve the quality of the category? YES / NO If YES, make changes directly to the category.

10. In the Interoperability category (9):

a. Is this category necessary for a simulation to support the MDMP? YES / NO

If NO, why not?

HLA compliant w/ what?

Are JAFIM, JTA & DII necessary

How about interop. w/ C4I systems?

b. Are all necessary references included? YES / NO

Should any references be added, changed, or deleted?

_____

_____

c. Do the measures and associated metrics provide a realistic evaluation tool for a simulation to support the sub-categories? YES / NO

If not, how should they be changed?

_____

_____

_____

_____

d. Could the phrasing or terminology be changed to improve the quality of the category? YES / NO If YES, make changes directly to the category.

11. In the Entity Behaviors category (10):

a. Is this category necessary for a simulation to support the MDMP? YES / NO

If NO, why not?

Behaviors should be simple! You want to make sure that differences in the outcome of two COAs are based on the COA's & not better entity decisions.

b. Are all necessary references included? YES / NO

Should any references be added, changed, or deleted?

_____

_____

c. Do the measures and associated metrics provide a realistic evaluation tool for a simulation to support the category? YES / NO

If not, how should they be changed?

d. Could the phrasing or terminology be changed to improve the quality of the category? YES / NO If YES, make changes directly to the category.

12. In the Recording category (11):

a. Is this category necessary for a simulation to support the MDMP? YES / NO

If NO, why not?

This would support AAR's

b. Are all necessary references included? YES / NO

Should any references be added, changed, or deleted?

Are there AAR refs from NTC?

c. Do the measures and associated metrics provide a realistic evaluation tool for a simulation to support the category? YES / NO

If not, how should they be changed?

d. Could the phrasing or terminology be changed to improve the quality of the category? YES / NO If YES, make changes directly to the category.

13. In the Decision Support category (12): Is this category necessary for a simulation to support the MDMP? YES / NO

If NO, why not?

YES! YES! YES! See some of my papers for some (BIASED) ideas about how this might be done.

14. Does the attached criteria accurately reflect user functionality concerns for a simulation supporting the MDMP (not including user interface and specific hardware requirements)? YES / NO

If NO, what criteria are missing? What criteria should be removed from the list?

None attached.

CRITERIA FOR SIMULATION DECISION SUPPORT IN THE MDMP

Category	Sub-Category / Question	Reference	Metric	Measure
1. Mission Receipt	Incorporates Higher Unit Graphics / 2	FM 101-5, FM 101-5-1, FBCB2 UFD	1-5; 1 = Cannot Incorporate 5 = Includes all FM 101-5-1 symbols and graphics. 2-4 scaled for % of symbols incorporated from FM 101-5-1.	*1 through 5
	Entity types / 1		Simulation Realistically models all major U.S. and threat equipment entity types and their capabilities. Including terrorist, guerrilla, and conventional threat types. Capable of introducing new types of entities.	GO/NO-GO
2. Mission Analysis	Represents the Modified Combined Obstacle Overlay (MCOO) / 3	FM 101-5, FM 34-130, FM 7-30, FM 21-26	Simulation Area of Operation (AO) scalable from 1 km2 to a minimum of 9x25 km. Area of Interest (AI) display capability.	GO/NO-GO
		FM 21-26	Simulation can represent 10 Terrain features: Cut, Fill, Hill, Saddle, Ridge, Valley, Spur, Draw, Cliff, Depression using accepted methods in FM 21-26.	GO/NO-GO
		FM 21-26, FM 5-33	Simulation models all vegetation types of Table 3-4, FM 5-33. Can represent all natural terrain surface configuration, soil features, water features, and obstacles IAW FM 5-33.	GO/NO-GO
		FM 21-26	Simulation is Military Grid Reference System (MGRS) compatible.	GO/NO-GO
		FBCB2 UFD	Simulation is DED, DTED compatible.	GO/NO-GO
		FM 90-10-1, OneSAF ORD, FM 5-33	Simulation uses verified models of urban and dynamic terrain including all man-made object types of Chapter 2, FM 5-33 and all obstacles in FM 101-5-1.	GO/NO-GO

VMF?

changes to terrain

CRITERIA FOR SIMULATION DECISION SUPPORT IN THE MDMP

Category	Sub-Category / Question	Reference	Metric	Measure
2. Mission Analysis (CONTINUED)	Represents the Modified Combined Obstacle Overlay (MCOO) / 3	ARTEP 7-30-MTP, FM 5-33, FM 34-130	Simulation represents all characteristics of the MCOO IAW "Conduct IPB" task and FM 34-130 by incorporating them from higher product or through user creation	GO/NO-GO
	Includes terrain sketch and COA sketch / modification tool / 2	FM 101-5	User can create / add / draw all above criteria, if necessary.	GO/NO-GO
	NBC / Weather analysis and modeling capabilities / 4	FM 34-130, FM 34-81-1, FM 3-6, FM 101-5	Simulation incorporates verified models of effects of all NBC agents, smoke, and weather types.	GO/NO-GO
	Graphic overlay creation tool and display methods capabilities / 2	FM 101-5, FBCB2 UFD	Simulation can distinguish /display from 0-10 overlays and can have at least 5 COAs open simulaneously. User can scale the display as desired. User can designate the Decisive Point (DP) and key terrain for the operation.	GO/NO-GO
		FM 34-130, ARTEP 7-30-MTP	User can create / display Enemy Event Templates, MCOO, SITTEMPs, doctrinal template, and event matrix. Simulation enables easy addition or deletion of graphical objects to any overlay.	GO/NO-GO
	Displays forces available (friendly and enemy) / 2	FM 101-5	Simulation allows loading of saved or doctrinal task organization. Allows easy changes to task org including support relationships.	GO/NO-GO
	Displays current situation / 2	ARTEP 7-30-MTP, FM 71.1	Simulation allows user to indicate Unit Basic Load (UBL), Controlled Supply Rates (CSRs) for supply classes I, III, IV, and V as a minimum. Also allows user to change entity supply configuration such as Armor Piercing (AP) heavy, fuel pods, rocket heavy for SEAD aircraft, etc.	GO/NO-GO

Decision Points NAI's & TAI's

TOO MUCH DETAIL

CRITERIA FOR SIMULATION DECISION SUPPORT IN THE MDMP

Category	Sub-Category / Question	Reference	Metric	Measure
2. Mission Analysis (CONTINUED)	Displays current situation / 2	ARTEP 7-30-MTP	User can assign Named Areas of Interest (NAI's) or sensors to entities by time, location, and/or type	GO/NO-GO
		FM 101-5	User can combine or separate units to task from individual to Brigade level (OPFOR division). User can "join" entities to others to conduct mounted or air movement.	GO/NO-GO
		FM 101-5, FM 3-0, ARTEP 7-30-MTP	User can assign priorities of support for units and battlefield functions to model command support relationships. This includes non-organic assets such as CAS naval gunfire, psyops, and signal.	GO/NO-GO
3. COA Development	Relative Combat Power Analysis (RCPA) / 2	FM 101-5	Simulation can calculate and display firepower and protection weighted force structures analysis for friendly and enemy forces based on the friendly and enemy task organization displayed at the time..	GO/NO-GO
	Line of Sight Tool / 4	OneSAF ORD	User can display individual entity or unit fields of fire over elevation and through foliage. Range fan depiction for each weapon/unit type. User can easily change entity location during COA setup or simulation.	GO/NO-GO
	Tasking / 2	AUTL (DA PAM 11-XX)	User can task entities IAW Sections 1 through 3 of Appendix D, of the AUTL. 1 = cannot task, 5 = includes all. 2-4 based on a subjective scale to be determined later.	"1 through 5

Not sufficient

Too much detail

Category	Sub-Category / Question	Reference	Metric	Measure
3. COA Development (CONTINUED)	Tasking / 2	FM 100-5 / FM 3-0	User can assign entities 1 of 5 forms of manuever (envelopment, turning movement, penetration, infiltration, or frontal attack) or 2 patterns of defense (mobile or area) (defend in sector or defend in battle position) or one of 13 stability and support operations / OOTW (see FM 3-0) or other tasks in the AUTL as specified above.	GO/NO-GO
		FM 100-5 / FM 3-0	to be achieved. User can change unit tasks by phase / time of the operation IAW the user developed synchronization matrix.	GO/NO-GO
			User can allocate SOPs to units, unit types, or entity types. User can establish global basic Rules of Engagement (ROE) for forces. User can copy routes, orders, SOP's and other Graphical Control Measures to entities.	GO/NO-GO
		ARTEP 7-30-MTP	User can associate risk with an asset by subjectively assigning criticality, vulnerability, recuperability, and threat.	GO/NO-GO
		FM 101-5	User can designate entities as Main Effort (ME) and Supporting Efforts (SE). Implications for this assignment include priority of support.	GO/NO-GO
		ARTEP 7-30-MTP	User can specify the method of employment for lift and attack aviation assets.	GO/NO-GO
		FM 101-5	User can assign headquarters to units, graphic control measures, and create an optional legend.	GO/NO-GO

Good!

CRITERIA FOR SIMULATION DECISION SUPPORT IN THE MDMP

Category	Sub-Category / Question	Reference	Metric	Measure
3. COA Development (CONTINUED)	Tasking / 2	FM 101-5	User can assign Purpose, Priority (effort and support), Allocation and Restrictions to capsbilities including Engineer Support, Artillery, CAS, ADA and other CS and CSS assets.	GO/NO-GO
		ARTEP 7-30-MTP	Simulation models Air Defense Artillery operations using weapons range fans, elevation, incidental coverage, terrain, graphics, and entity behaviors (including passive air defense, weapon control status, and warning status). Simulation can depict radar coverage in the area of interest.	GO/NO-GO
		ARTEP 7-30-MTP	Simulation models Casualty Evacuation (CASEVAC) operations and resupply with verified models. Also allows bookkeeping of supply classes I, III, IV and V beginning with doctrinal levels or user input. Allows creation of CSS overlay and all other required overlays.	GO/NO-GO
		ARTEP 7-30-MTP, FM 6-20-10	Simulation accurately models targeting (of entity types) through allocation of the essential fire support tasks including the objective, formation, and function for each target, with its purpose, method, and effects. Also allows assignment of trigger points for artillery targets. User can associate trigger points with decision points, NAI's, or Targeted Areas of Interest (TAI's). User can designate entities as target observers.	GO/NO-GO

Might be too much detail

CRITERIA FOR SIMULATION DECISION SUPPORT IN THE MDMP

Category	Sub-Category / Question	Reference	Metric	Measure
3. COA Development (CONTINUED)	Tasking / 2	FM 100-5 / FM 3-0	User can issue Priority of fires, Time on Target, engagement criteria, and priority targets for all weapon / entity types. User can designate entity types as High Payoff Targets (HPTs).	GO/NO-GO
		FM 7-98, FM 71-1	Simulation can model air and ground resupply including service station, tailgate, and emergency resupply. This includes FAARP, LOGPAC, ROM, FLE, and Forward Support Company (FSC) operations, and Blackstar technique as a minimum for classes I, III, IV, and V..	GO/NO-GO
		ARTEP 7-30-MTP	Simulation accurately models 4 types of breaching operations, assault, in-stride, covert, and deliberate. Simulation accurately models 3 types of route clearance operations, Linear, Combat, and Combined.	GO/NO-GO
		ARTEP 7-30-MTP	User can create obstacle zones, belts, or groups with obstacle intent graphics that act as dynamic terrain in aggregated simulation. Simulation gives estimate of Class IV and time requirements based on obstacle type and dimensions.	GO/NO-GO
4. COA Analysis	War-gaming / 2	FM 101-5	Simulation enables Action / Reaction / Counteraction war-gaming.	GO/NO-GO
		FM 101-5	Simulation uses a method for recording the war game.	GO/NO-GO

CRITERIA FOR SIMULATION DECISION SUPPORT IN THE MDMP

Category	Sub-Category / Question	Reference	Metric	Measure
4. COA Analysis (CONTINUED)	War-gaming / 2	FM 101-5	Simulation allows unlimited user-defined branch and sequel analysis including contingencies, reserve operations, and other decision dependent situations User can specify abort criteria for units and tasks.	GO/NO-GO
			Simulation uses verified movement and attrition models for direct and indirect (and EW) weapons including fratricide for each entity type.	OK
			Simulation adequately models all current munition types and their effects. Also allows addition of munition types.	X GO/NO-GO
		ARTEP 7-30-MTP	Simulation accurately models Mobility (SOSR), Countermobility (effects), and Survivability operations and fortifications using dynamic terrain, graphics, and entity behaviors.	GO/NO-GO
			Simulation models signals used for communication such as star clusters.	
		FM 101-5	Simulation allows war-gaming by belt, box, and avenue methods	GO/NO-GO
		ARTEP 7-30-MTP	Simulation facilitates creation of the Decision Support Template (DST), Target Synchronization Matrix, Fire Support Execution Matrix (FSEM), Target List Worksheet, and Execution Matrix and other decision support tools.	GO/NO-GO

CRITERIA FOR SIMULATION DECISION SUPPORT IN THE MDMP

Category	Sub-Category / Question	Reference	Metric	Measure
5. COA Comparison	2	FM 101-5	Simulation provides standard criteria for COA comparison with adequate estimates of criteria such as supply (class I, III, IV, V) consumption, casualties, relative risk, mass, etc for each COA.	GO/NO-GO
6. COA Briefing and Approval	See orders production and briefing			
7. Orders Production and Briefing	Electronic Distribution / 2	FBCB2 UFD	Simulation allows saving and export of all war-game executions.	GO/NO-GO
		FBCB2 UFD	Simulation allows saving, export, and printing (to scale or as user determined) of all overlays and graphics.	GO/NO-GO
	Briefing / 2	OneSAF ORD	Simulation allows rapid COA replay.	GO/NO-GO
		OneSAF ORD	Simulation allows voice capture.	GO/NO-GO
8. Flexibility	4	OneSAF ORD, Barone & Roberts, Garrabrants &Blais, Surdu	Simulation is real-time and much faster than real time capable. (Time compression of at least 9:1).	GO/NO-GO
		OneSAF ORD, Barone & Roberts, Garrabrants &Blais, Surdu	User can easily execute a COA simulation using any combination of overlays for contingency analysis. Simulation is interruptible and changeable (entity locations and tasks, etc.) while the COA is executing.	GO/NO-GO
		OneSAF ORD	The simulation can model up to 10 sides / factions including civilians and Non-Governmental Organizations (NGO's).	GO/NO-GO

Need to be tailorable

what does this mean?

yes!

CRITERIA FOR SIMULATION DECISION SUPPORT IN THE MDMP

Category	Sub-Category / Question	Reference	Metric	Measure
8. Flexibility (CONTINUED)	4		Simulation is executable on as many Operating Systems as determined feasible by the responsible agency.	GO/NO-GO
			Simulation enables quick (< 1 minute) loading of COAs.	GO/NO-GO
9. Interoperability	Standards	AR 5-11	Simulation is High Level Architecture (HLA) Compliant.	GO/NO-GO
		AR 5-11	Simulation complies with DOD Technical Architecture Framework for Information Management (TAFIM).	GO/NO-GO
		AR 5-11	Simulation is compatible with the Joint Technical Architecture (JTA).	GO/NO-GO
	Collaborative Planning 2 / 4	JMACE experiment, FBCB2 UFD	Simulation is Distributed and Interactive with messaging, real time drawing, commander synchronization control, and MDMP timeline capabilities.	GO/NO-GO
	Run Time modes / 4	OneSAF ORD	Simulation can run in stand-alone, linked, or networked modes	GO/NO-GO
10. Entity Behaviors	1	OneSAF CRD	Simulation can fully automate entity behaviors during war-game simulations, including battlefield congestion.	GO/NO-GO
			Simulation uses a verified model for unit communications.	GO/NO-GO
		OneSAF ORD	CGF entities recognize graphics (All of FM 101-5-1) including boundaries, control and coordination measures, TRPs, NAI's, objectives, and obstacles and behave accordingly at them.	GO/NO-GO

CRITERIA FOR SIMULATION DECISION SUPPORT IN THE MDMP

Category	Sub-Category / Question	Reference	Metric	Measure
10. Entity Behaviors (CONTINUED)		OneSAF ORD	CGF entities experience behavioral degradation from the effects of terrain, weather, and operations.	GO/NO-GO
		OneSAF ORD	Entities behave appropriately on all types of terrain, trafficability, vegetation, and features.	GO/NO-GO
11. Recording	4	OneSAF ORD	Simulation allows saving of multiple COA war-game iterations for each mission.	GO/NO-GO
	Logging Capability / 4	OneSAF ORD	Simulation can record and store COA run data including time, entity location, action, and results in a user-friendly database.	GO/NO-GO
11. Recording (CONTINUED)	Logging Capability / 4		Simulation records/estimates COA personnel and equipment losses with supply status usage.	GO/NO-GO
12. Decision Support	Not addressed in this research			

Part 3: Mr. Johnson

1. Do the 12 categories in the attached criteria address all aspects of a simulation supporting the current MDMP process at the tactical level? YES / NO

   If NO, why not?

   _____

   _____

   _____

   _____

2. In the Mission Receipt category (1):
   a. Do the sub-categories sufficiently address category attributes? YES / NO

      If NO, why not?

      It should incorporate the textual mission, intent, objectives, etc. of higher.

   b. Are all necessary references included? YES / NO

      Should any references be added, changed, or deleted?

      _____

      _____

   c. Do the measures and associated metrics provide a realistic evaluation tool for a simulation to support the sub-category? YES / NO

      If not, how should they be changed?

      What constitutes a No-Go? What constitutes "realistic" behavior? Broad metrics may be necessary for this category, but there has to be an equal understanding of terms. "All" equipment and entity types is a big job. 1-5 scale may be better.

   d. Could the phrasing or terminology be changed to improve the quality of the category? YES / NO If YES, make changes directly to the category.

      Just ensure everyone understands the terms used.

This is true throughout the metrics. It sounds like common sense, but many sims are ruined by a lack of understanding of terms/metrics.

1

3. In the Mission Analysis category (2):
   a. Do the sub-categories sufficiently address category attributes? YES / NO

      If NO, why not?

      _____

      _____

   b. Are all necessary references included? YES / NO

      Should any references be added, changed, or deleted?

      _____

      _____

   c. Do the measures and associated metrics provide a realistic evaluation tool for a simulation to support the sub-category? YES / NO

      If not, how should they be changed?

      _____

      _____

      _____

      _____

   d. Could the phrasing or terminology be changed to improve the quality of the category? YES NO If YES, make changes directly to the category.

4. In the COA Development category (3):
   a. Do the sub-categories sufficiently address category attributes? YES / NO

      If NO, why not?

      _____

      _____

b. Are all necessary references included? YES / NO

Should any references be added, changed, or deleted?

c. Do the measures and associated metrics provide a realistic evaluation tool for a simulation to support the sub-category? YES / NO

If not, how should they be changed?

SEE P 4 & 5

d. Could the phrasing or terminology be changed to improve the quality of the category? YES / NO If YES, make changes directly to the category.

he COA Analysis category (4):

a. Does the sub-category sufficiently address category attributes? YES / NO

If NO, why not?

b. Are all necessary references included? YES / NO

Should any references be added, changed, or deleted?

c. Do the measures and associated metrics provide a realistic evaluation tool for a simulation to support the sub-category? YES / NO

If not, how should they be changed?

_____

_____

_____

_____

d. Could the phrasing or terminology be changed to improve the quality of the category? YES / NO If YES, make changes directly to the category.

6. In the COA Comparison category (5):

a. Does the sub-category sufficiently address category attributes? YES / NO

If NO, why not?

_____

_____

b. Are all necessary references included? YES / NO

Should any references be added, changed, or deleted?

_____

_____

c. Does the measure and associated metric provide a realistic evaluation tool for a simulation to support the sub-category? YES / NO

If not, how should they be changed?

_____

_____

_____

_____

d. Could the phrasing or terminology be changed to improve the quality of the category? YES / NO If YES, make changes directly to the category.

7. In the COA Briefing and Approval category (6), can simulation support this category in any ~~way~~ other than included in category 7, Orders Production and Briefing? YES / NO

If YES, please explain.

8. In the Orders Production and Briefing category (7):

a. Do the sub-categories sufficiently address category attributes? YES / NO

If NO, why not?

b. Are all necessary references included? YES / NO

Should any references be added, changed, or deleted?

c. Do the measures and associated metrics provide a realistic evaluation tool for a simulation to support the sub-categories? YES / NO

If not, how should they be changed?

Print out Execution matrix

d. Could the phrasing or terminology be changed to improve the quality of the category? YES / (NO) If YES, make changes directly to the category.

9. In the Flexibility category (8):

a. Is this category necessary for a simulation to support the MDMP? (YES) NO

~~If NO, why not?~~ ABSOLUTELY !!

This category will determine if the sim builders build a sim that soldiers in the field will use.

b. Are all necessary references included? (YES) / NO

Should any references be added, changed, or deleted?

c. Do the measures and associated metrics provide a realistic evaluation tool for a simulation to support the category? YES / (NO)

If not, how should they be changed?

9:1 time compression is not suitable for "in the field", COA production and analysis. Minimum of 60:1 required.

d. Could the phrasing or terminology be changed to improve the quality of the category? (YES) / NO If YES, make changes directly to the category.

10. In the Interoperability category (9):

a. Is this category necessary for a simulation to support the MDMP? (YES) NO

If NO, why not?

b. Are all necessary references included? (YES) / NO

Should any references be added, changed, or deleted?

c. Do the measures and associated metrics provide a realistic evaluation tool for a simulation to support the sub-categories? YES / (NO)

If not, how should they be changed?

I would say it should be PC based. Units in the field are more likely to have them. A staff/cdr should be able to develop/run a COA on a laptop.

d. Could the phrasing or terminology be changed to improve the quality of the category? YES / (NO) If YES, make changes directly to the category.

11. In the Entity Behaviors category (10):

a. Is this category necessary for a simulation to support the MDMP? (YES) / NO

If NO, why not?

b. Are all necessary references included? (YES) / NO

Should any references be added, changed, or deleted?

c. Do the measures and associated metrics provide a realistic evaluation tool for a simulation to support the category? YES / NO

If not, how should they be changed?

_____

_____

_____

_____

d. Could the phrasing or terminology be changed to improve the quality of the category? YES / NO If YES, make changes directly to the category.

12. In the Recording category (11):

a. Is this category necessary for a simulation to support the MDMP? YES / NO

If NO, why not?

_____

_____

b. Are all necessary references included? YES / NO

Should any references be added, changed, or deleted?

_____

_____

c. Do the measures and associated metrics provide a realistic evaluation tool for a simulation to support the category? YES / NO

If not, how should they be changed?

_____

_____

_____

_____

d. Could the phrasing or terminology be changed to improve the quality of the category? YES / NO If YES, make changes directly to the category.

13. In the Decision Support category (12): Is this category necessary for a simulation to support the MDMP? YES / NO

If NO, why not?

_____

_____

_____

_____

14. Does the attached criteria accurately reflect user functionality concerns for a simulation supporting the MDMP (not including user interface and specific hardware requirements)? YES / NO

If NO, what criteria are missing? What criteria should be removed from the list?

_____

_____

_____

_____

_____

Category	Sub-Category / Question	Reference	Metric	Measure
3. COA Development (CONTINUED)	Tasking / 2	FM 100-5 / FM 3-0	User can assign entities 1 of 5 forms of maneuver (envelopment, turning movement, penetration, infiltration, or frontal attack) or 2 patterns of defense (mobile or area) (defend in sector or defend in battle position) or one of 13 stability and support operations / OOTW (see FM 3-0) or other tasks in the AUTL as specified above.	GO/NO-GO
		?	to be achieved. User can change unit tasks by phase / time of the operation IAW the user	
		FM 100-5 / FM 3-0	developed synchronization matrix.	GO/NO-GO
			User can allocate SOPs to units, unit types, or entity types. User can establish global basic Rules of Engagement (ROE) for forces. User can copy routes, orders, SOP's and other Graphical Control Measures to entities.	GO/NO-GO
		ARTEP 7-30-MTP	User can associate risk with an asset by subjectively assigning criticality, vulnerability, recuperability, and threat.	GO/NO-GO
		FM 101-5	User can designate entities as Main Effort (ME) and Supporting Efforts (SE). Implications for this assignment include priority of support.	GO/NO-GO
		ARTEP 7-30-MTP	User can specify the method of employment for lift and attack aviation assets.	GO/NO-GO
		FM 101-5	User can assign headquarters to units, graphic control measures, and create an optional legend.	GO/NO-GO

If you are assigning priorities by a units "effort" designation, isn't redundant doing it again. (see 1ST metric p. 3)

CRITERIA FOR SIMULATION DECISION SUPPORT IN THE MDMP

Category	Sub-Category / Question	Reference	Metric	Measure
3. COA Development (CONTINUED)	Tasking / 2	FM 101-5	User can assign Purpose, Priority (effort and support), Allocation and Restrictions to capabilities including Engineer Support, Artillery, CAS, ADA and other CS and CSS assets.	GO/NO-GO
		ARTEP 7-30-MTP	Simulation models Air Defense Artillery operations using weapons range fans, elevation, incidental coverage, terrain, graphics, and entity behaviors (including passive air defense, weapon control status, and warning status). Simulation can depict radar coverage in the area of interest.	GO/NO-GO
		ARTEP 7-30-MTP	Simulation models Casualty Evacuation (CASEVAC) operations and resupply with verified models. Also allows bookkeeping of supply classes I, III, IV and V beginning with doctrinal levels or user input. Allows creation of CSS overlay and all other required overlays.	GO/NO-GO
		ARTEP 7-30-MTP, FM 6-20-10	Simulation accurately models targeting (of entity types) through allocation of the essential fire support tasks including the objective, formation, and function for each target, with its purpose, method, and effects. Also allows assignment of trigger points for artillery targets. User can associate trigger points with decision points, NAI's, or Targeted Areas of Interest (TAI's). User can designate entities as target observers.	GO/NO-GO

CRITERIA FOR SIMULATION DECISION SUPPORT IN THE MDMP

Is this multi-player? I am unclear what this means.

Category	Sub-Category / Question	Reference	Metric	Measure
8. Flexibility (CONTINUED)	4		Simulation is executable on as many Operating Systems as determined feasible by the responsible agency.	GO/NO-GO
			~~Simulation enables~~ quick (< 1 minute) loading of COAs.	GO/NO-GO
9. Interoperability	Standards	AR 5-11	Simulation is High Level Architecture (HLA) Compliant.	GO/NO-GO
		AR 5-11	Simulation complies with DOD Technical Architecture Framework for Information Management (TAFIM).	GO/NO-GO
		AR 5-11	Simulation is compatible with the Joint Technical Architecture (JTA).	GO/NO-GO
	Collaborative Planning 2 / 4	JMACE experiment, FBCB2 UFD	Simulation is Distributed and interactive with messaging, real time drawing, commander synchronization control, and MDMP timeline capabilities.	GO/NO-GO
	Run Time modes / 4	OneSAF ORD	Simulation can run in stand-alone, linked, or networked modes	GO/NO-GO
10. Entity Behaviors	1	OneSAF ORD	Simulation can fully automate entity behaviors during war-game simulations, including battlefield congestion.	GO/NO-GO
			Simulation uses a verified model for unit communications.	GO/NO-GO
		OneSAF ORD	CGF entities recognize graphics (All of FM 101-5-1) including boundaries, control and coordination measures, TRPs, NAI's, objectives, and obstacles and behave accordingly at them.	GO/NO-GO

Part 4: LTC Wilmer

1. Do the 12 categories in the attached criteria address all aspects of a simulation supporting the current MDMP process at the tactical level? YES / NO

   If NO, why not?

   Tool needs to be collaborative so different nodes can work together in a synchronized fashion.

2. In the Mission Receipt category (1):
   a. Do the sub-categories sufficiently address category attributes? YES / NO

      If NO, why not?

      Need a tool to develop specified, implied & essential tasks, develop restated mission & cdr's intent

   b. Are all necessary references included? YES / NO

      Should any references be added, changed, or deleted?

   c. Do the measures and associated metrics provide a realistic evaluation tool for a simulation to support the sub-category? YES / NO

      If not, how should they be changed?

      Most models will not pass a GO/NOGO criteria that requires them to do all of something. Remember, models are built for a specific purpose & more intended to do all. Good ones are properly scaled to focus on things important to the problem.

   d. Could the phrasing or terminology be changed to improve the quality of the category? YES / NO If YES, make changes directly to the category.

1

3. In the Mission Analysis category (2):
   a. Do the sub-categories sufficiently address category attributes? YES / (NO)

      If NO, why not?

      Tool needs to upload current sit from a C2 device (FBCB2 or MCS)

   b. Are all necessary references included? YES / NO

      Should any references be added, changed, or deleted?

      _____

      _____

   c. Do the measures and associated metrics provide a realistic evaluation tool for a simulation to support the sub-category? YES / (NO)

      If not, how should they be changed?

      Some of these, like weather report, are difficult problems. You probably want some scalable response. Not sure an MDMP tool needs to do constant dynamic weather effects, but you probably want to display major factors in blocks of time.

   d. Could the phrasing of terminology be changed to improve the quality of the category? YES / NO If YES, make changes directly to the category.

4. In the COA Development category (3):
   a. Do the sub-categories sufficiently address category attributes? YES / (NO)

      If NO, why not?

      There might be too much here. If the goal is criteria for a tool to do real time tactical decision making we have to carefully balance level of detail required w/ speed and ease of use. To develop a COA, I'd want an interactive screen where I can choose a unit, and give it mission parameters and also draw in control measures. Should include basic functions for CBT, CBT SPT & CBT Service Spt.

b. Are all necessary references included? (YES) / NO

Should any references be added, changed, or deleted?

c. Do the measures and associated metrics provide a realistic evaluation tool for a simulation to support the sub-category? YES / NO

If not, how should they be changed?

Is where do you evaluate the ability to build multiple COAs, store them, modify them, and potentially combine pieces of different ones.

d. Could the phrasing or terminology be changed to improve the quality of the category? (YES) / NO If YES, make changes directly to the category.

Organize subcategories into some step by step process of developing a COA.

5. In the COA Analysis category (4):

a. Does the sub-category sufficiently address category attributes? (YES) / NO

If NO, why not?

b. Are all necessary references included? YES / NO

Should any references be added, changed, or deleted?

c. Do the measures and associated metrics provide a realistic evaluation tool for a simulation to support the sub-category? YES / NO

If not, how should they be changed?

why do you want to be evaluated on as many platforms

"use a method for recording" is too vague

d. Could the phrasing or terminology be changed to improve the quality of the category? YES / NO If YES, make changes directly to the category.

6. In the COA Comparison category (5):

a. Does the sub-category sufficiently address category attributes? YES / NO

If NO, why not?

b. Are all necessary references included? YES / NO

Should any references be added, changed, or deleted?

c. Does the measure and associated metric provide a realistic evaluation tool for a simulation to support the sub-category? YES / NO

If not, how should they be changed?

d. Could the phrasing or terminology be changed to improve the quality of the category? YES / NO If YES, make changes directly to the category.

7. In the COA Briefing and Approval category (6), can simulation support this category in any way other than included in category 7, Orders Production and Briefing? YES / NO

If YES, please explain.

Simulation might include standard templates for the briefings in the MDMP process. Then as AO works he can export directly to a briefing template and provide immediate brief

8. In the Orders Production and Briefing category (7):

a. Do the sub-categories sufficiently address category attributes? YES / NO

If NO, why not?

b. Are all necessary references included? YES / NO

Should any references be added, changed, or deleted?

c. Do the measures and associated metrics provide a realistic evaluation tool for a simulation to support the sub-categories? YES / NO

If not, how should they be changed?

d. Could the phrasing or terminology be changed to improve the quality of the category? YES / NO If YES, make changes directly to the category.

9. In the Flexibility category (8):

a. Is this category necessary for a simulation to support the MDMP? (YES) / NO

If NO, why not?

b. Are all necessary references included? YES / NO

Should any references be added, changed, or deleted?

c. Do the measures and associated metrics provide a realistic evaluation tool for a simulation to support the category? YES / (NO)

If not, how should they be changed?

- Why 10 sides?
- Why many OSs? Should we target what's compatible w/ C2 devices

d. Could the phrasing or terminology be changed to improve the quality of the category? YES / NO If YES, make changes directly to the category.

10. In the Interoperability category (9):

a. Is this category necessary for a simulation to support the MDMP? (YES) / NO

If NO, why not?

b. Are all necessary references included? YES / NO

Should any references be added, changed, or deleted?

c. Do the measures and associated metrics provide a realistic evaluation tool for a simulation to support the sub-categories? (YES) / NO

If not, how should they be changed?

d. Could the phrasing or terminology be changed to improve the quality of the category? YES / NO If YES, make changes directly to the category.

11. In the Entity Behaviors category (10):

a. Is this category necessary for a simulation to support the MDMP? YES / (NO)

If NO, why not?

It's only useful for a company cdr. above that I want to model units not entities

b. Are all necessary references included? YES / NO

Should any references be added, changed, or deleted?

c. Do the measures and associated metrics provide a realistic evaluation tool for a simulation to support the category? YES / NO

If not, how should they be changed?

_____

_____

_____

_____

d. Could the phrasing or terminology be changed to improve the quality of the category? YES / NO If YES, make changes directly to the category.

12. In the Recording category (11):

a. Is this category necessary for a simulation to support the MDMP? YES / NO

If NO, why not?

_____

_____

b. Are all necessary references included? YES / NO

Should any references be added, changed, or deleted?

_____

_____

c. Do the measures and associated metrics provide a realistic evaluation tool for a simulation to support the category? YES / NO

If not, how should they be changed?

_____

_____

_____

_____

d. Could the phrasing or terminology be changed to improve the quality of the category? YES / NO If YES, make changes directly to the category.

13. In the Decision Support category (12): Is this category necessary for a simulation to support the MDMP? YES / NO

If NO, why not?

_____

_____

_____

_____

14. Does the attached criteria accurately reflect user functionality concerns for a simulation supporting the MDMP (not including user interface and specific hardware requirements)? YES / NO

If NO, what criteria are missing? What criteria should be removed from the list?

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Part 5: LTC Riese

1. Do the 12 categories in the attached criteria address all aspects of a simulation supporting the current MDMP process at the tactical level? YES / (NO)

If NO, why not?

should consider the role of the commander, the commander's guidance & commander's intent

2. In the Mission Receipt category (1):

a. Do the sub-categories sufficiently address category attributes? YES / (NO)

If NO, why not?

does the simulation incorporate higher units' commanders' intent?

b. Are all necessary references included? (YES) NO not sure?

Should any references be added, changed, or deleted?

c. Do the measures and associated metrics provide a realistic evaluation tool for a simulation to support the sub-category? YES / (NO)

If not, how should they be changed?

GO/NO-GO probably not refined enough to compare simulation models -- scale 1-5 or 1-10 gives a better picture of capability differences

d. Could the phrasing or terminology be changed to improve the quality of the category? (YES) / NO If YES, make changes directly to the category.

"Simulation Realistically models..." is pretty broad. Sims can't be all things to all people. Should probably focus the level of resolution with either "tactical" or "brigade/battalion level"

3. In the Mission Analysis category (2):
   a. Do the sub-categories sufficiently address category attributes? (YES) / NO

      If NO, why not?

      _____

      _____

   b. Are all necessary references included? (YES) / NO

      Should any references be added, changed, or deleted?

      _____

      _____

   c. Do the measures and associated metrics provide a realistic evaluation tool for a simulation to support the sub-category? YES / (NO)

      If not, how should they be changed?

      Same comment as 2.c. System should account for different levels of quality in ranking the metrics. (General comment – some metrics may be fine as GO/NO-GO)

   d. Could the phrasing or terminology be changed to improve the quality of the category? (YES) / NO If YES, make changes directly to the category.
      Not sure about FM 21-26 & the 10 terrain types. If sim adequately represents terrain for mobility and line of sight, does it really need to be able to explicitely represent 10 terrain types?

4. In the COA Development category (3):
   a. Do the sub-categories sufficiently address category attributes? YES / (NO)

      If NO, why not?

      Good point to add something to measure capability to incorporate commander's planning guidance

b. Are all necessary references included? (YES) / NO not sure

Should any references be added, changed, or deleted?

c. Do the measures and associated metrics provide a realistic evaluation tool for a simulation to support the sub-category? YES / (NO)

If not, how should they be changed?

(1) see comment for 2.c. on GO/NO-GO

(2) 4 types of breaching operations -- at the bde/bn level these are really tied to the maneuver plan -- does this mean that the sim should have "battle drills" built in?

d. Could the phrasing or terminology be changed to improve the quality of the category? YES / (NO) If YES, make changes directly to the category.

5. In the COA Analysis category (4):

a. Does the sub-category sufficiently address category attributes? YES / (NO)

If NO, why not?

Consider dividing category into two parts: staff estimate & wargaming -- unless this is covered in COA comparison.

b. Are all necessary references included? (YES) / NO

Should any references be added, changed, or deleted?

c. Do the measures and associated metrics provide a realistic evaluation tool for a simulation to support the sub-category? YES / (NO)

If not, how should they be changed?

See comment 6a on GO/NO-GO criteria.

d. Could the phrasing or terminology be changed to improve the quality of the category? YES / (NO) If YES, make changes directly to the category.

6. In the COA Comparison category (5):

a. Does the sub-category sufficiently address category attributes? (YES) / NO

If NO, why not?

however, see 5.a.

b. Are all necessary references included? (YES) NO

Should any references be added, changed, or deleted?

c. Does the measure and associated metric provide a realistic evaluation tool for a simulation to support the sub-category? YES / (NO)

If not, how should they be changed?

should probably spell out/list the categories. Each one could get a GO/NO-GO score

d. Could the phrasing or terminology be changed to improve the quality of the category? (YES) / NO If YES, make changes directly to the category.

See 6.c.

7. In the COA Briefing and Approval category (6), can simulation support this category in any way other than included in category 7, Orders Production and Briefing?
(YES) / NO

If YES, please explain.

Sim should allow for rapid (on the fly) changes to the COAs i.e, commanders often say "Take part of COA A and part of COA B," or they simply switch units, control measures, etc. at the time of the brief

8. In the Orders Production and Briefing category (7):

a. Do the sub-categories sufficiently address category attributes? (YES) NO

If NO, why not?

b. Are all necessary references included? YES / (NO) FM 101-5 ?

Should any references be added, changed, or deleted?

FM 101-5 ?

c. Do the measures and associated metrics provide a realistic evaluation tool for a simulation to support the sub-categories? YES / (NO)

If not, how should they be changed?

See 7

d. Could the phrasing or terminology be changed to improve the quality of the category? (YES) / NO If YES, make changes directly to the category.

9. In the Flexibility category (8): → what is voice capture?

a. Is this category necessary for a simulation to support the MDMP? (YES) / NO

If NO, why not?

b. Are all necessary references included? (YES) / NO ?

Should any references be added, changed, or deleted?

c. Do the measures and associated metrics provide a realistic evaluation tool for a simulation to support the category? YES / (NO)

If not, how should they be changed?

(1) Intuition tells me that 9:1 time compression will not be fast enough -- should have ability to fast forward / skip portions of the plan during rehearsing & replay

(2) 10 sides may not be enough. In Bosnia, tactical commanders had to deal with 20 or more entities.

d. Could the phrasing or terminology be changed to improve the quality of the category? YES / (NO) If YES, make changes directly to the category.

10. In the Interoperability category (9):

a. Is this category necessary for a simulation to support the MDMP? (YES) / NO

If NO, why not?

b. Are all necessary references included? YES / NO ?

Should any references be added, changed, or deleted?

c. Do the measures and associated metrics provide a realistic evaluation tool for a simulation to support the sub-categories? YES / NO

If not, how should they be changed?

① why does sim need to be HLA compliant? will this be a bonus on the sim?

② will linked sim allow a bde commander/staff to wargame/rehearse based on results of subordinate sim executions?

d. Could the phrasing or terminology be changed to improve the quality of the category? YES / NO If YES, make changes directly to the category.

11. In the Entity Behaviors category (10):

a. Is this category necessary for a simulation to support the MDMP? YES NO

If NO, why not?

b. Are all necessary references included? YES NO ?

Should any references be added, changed, or deleted?

Nothing besides OneSAF and an entity behavior?

c. Do the measures and associated metrics provide a realistic evaluation tool for a simulation to support the category? YES / (NO)

If not, how should they be changed?

① Not sure about "verified model for unit comms." does this mean the model may be unverified?

② Sim should have method to easily/rapidly change enemy/non-combatant COA's/actions.

d. Could the phrasing or terminology be changed to improve the quality of the category? YES / (NO) If YES, make changes directly to the category.

12. In the Recording category (11):

a. Is this category necessary for a simulation to support the MDMP? (YES) NO

If NO, why not?

b. Are all necessary references included? (YES) NO ?

Should any references be added, changed, or deleted?

c. Do the measures and associated metrics provide a realistic evaluation tool for a simulation to support the category? YES / (NO)

If not, how should they be changed?

Sim should allow for input of actual results for AAR comparison

d. Could the phrasing or terminology be changed to improve the quality of the category? YES / NO If YES, make changes directly to the category.

13. In the Decision Support category (12): Is this category necessary for a simulation to support the MDMP? YES / NO

If NO, why not?

_____

_____

_____

_____

14. Does the attached criteria accurately reflect user functionality concerns for a simulation supporting the MDMP (not including user interface and specific hardware requirements)? YES / NO

If NO, what criteria are missing? What criteria should be removed from the list?

_____

_____

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_____

_____

Overall: Very good list

② consider a set of higher-level questions such as, "Does this sim assist the planning staff and commander in the MDMP?" This addresses the usability of the sim but goes beyond user interface.

③ good luck w/ your thesis!

Part 6: LTC Lee

COMMENTS REGARDING –
SIMULATION DECISION SUPPORT IN THE MDMP:
A FRAMEWORK WITH ASSOCIATED METRICS
Master's Thesis by Andy Farnsler, 18-Dec-00
SUBJECT MATTER EXPERT SURVEY
Provided by LTC John Lee

GENERAL. Valid framework. Good accounting of the process. Appropriate overarching references. Adequate criteria and metrics; excellent when compared to any similar, current documentation.

SPECIFIC. (By category/sub-category/question when possible to link.)

- COA Development/Tasking/2: Metric describes forms of maneuver, patterns of defense, types/forms of SASO and suggests 13 SASO/OOTW tasks. Quick scan of FM 3-0 reveals 25 possible stability and support operations. Mention this not to sharp shoot specifics but to highlight significant database, flexibility, and user update capability requirements of an MDMP decision support simulation.
- COA Development/Tasking/2: Metric suggests capability to allocate and copy SOPs to units and entities. Potentially, SOPs can vary between and among units. For example, a battalion SOP can probably be allocated to all units within the battalion. However, brigade and higher-level SOPs do not apply across all subordinate units. Perhaps this also highlights database and flexibility requirements of the tool.
- COA Analysis/War-gaming/2: COA Analysis should include capability to identify and assess risk in close, deep, and rear activities, as part of offensive and defensive operations, and in each of the types/forms of stability and support operations. Risk identification and assessment not addressed in metrics.
- Overall Observation (Applies to Multiple Categories): No capability to incorporate non-graphical inputs identified. Throughout the MDMP, verbal and written information that impacts on each category is provided or developed. Examples are facts and assumptions developed upon mission receipt; commander's guidance, which can occur in all categories; and staff plans that do not lend themselves to graphic representation (e.g., personnel system activities, civil affairs, communication network considerations, and maintenance activities). Non-graphical inputs not fully addressed in metrics.
- Suggested Additions: These would enhance the tool, but are not necessary.
  - Reminders throughout of important information to pass higher, lower and adjacent (warning orders, requests for clarification, requests for effects or material support, suggestions for graphics changes, etc.)
  - Continual reminders of time remaining to produce an order (based on 1/3-2/3, 1/5-4/5, or time limit set by unit commander).

- Future Effort: References cited are generally good. However, best references used regularly during tactical planning often are special publications and student texts available from professional military schools. Eventually, when building this tool, developers must conduct more in-depth research into less well-known references.

CRITERIA FOR SIMULATION DECISION SUPPORT IN THE MDMP

Category	Sub-Category / Question	Reference	Metric	Measure
1. Mission Receipt	Incorporates Higher Unit Graphics / 2	FM 101-5, FM 101-5-1, FBCB2 UFD	1-5; 1 = Cannot incorporate 5 = Includes all FM 101-5-1 symbols and graphics. 2-4 scaled for % of symbols incorporated from FM 101-5-1.	*1 through 5
	Entity types / 1		Simulation Realistically models all major U.S. and threat equipment entity types and their capabilities. Including terrorist, guerrilla, and conventional threat types. Capable of introducing new types of entities.	GO/NO-GO
2. Mission Analysis	Represents the Modified Combined Obstacle Overlay (MCOO) / 3	FM 101-5, FM 34-130, FM 7-30, FM 21-26	Simulation Area of Operation (AO) scalable from 1 km2 to a minimum of 9x25 km. Area of interest (AI) display capability.	GO/NO-GO
		FM 21-26	Simulation can represent 10 Terrain features: Cut, Fill, Hill, Saddle, Ridge, Valley, Spur, Draw, Cliff, Depression using accepted methods in FM 21-26.	GO/NO-GO
		FM 21-26, FM 5-33	Simulation models all vegetation types of Table 3-4, FM 5-33. Can represent all natural terrain surface configuration, soil features, water features, and obstacles IAW FM 5-33.	GO/NO-GO
		FM 21-26	Simulation is Military Grid Reference System (MGRS) compatible.	GO/NO-GO
		FBCB2 UFD	Simulation is DED, DTED compatible.	GO/NO-GO
		FM 90-10-1, OneSAF ORD, FM 5-33	Simulation uses verified models of urban and dynamic terrain including all man-made object types of Chapter 2, FM 5-33 and all obstacles in FM 101-5-1.	GO/NO-GO

CRITERIA FOR SIMULATION DECISION SUPPORT IN THE MDMP

Category	Sub-Category / Question	Reference	Metric	Measure
2. Mission Analysis (CONTINUED)	Displays current situation / 2	ARTEP 7-30-MTP	User can assign Named Areas of Interest (NAI's) or sensors to entities by time, location, and/or type	GO/NO-GO
Commander's Guidance (Non-graphical input)		FM 101-5	User can combine or separate units to task from individual to Brigade level (OPFOR division). User can "join" entities to others to conduct mounted or air movement.	GO/NO-GO
		FM 101-5, FM 3-0, ARTEP 7-30-MTP	User can assign priorities of support for units and battlefield functions to model command support relationships. This includes non-organic assets such as CAS naval gunfire, psyops, and signal.	GO/NO-GO
3. COA Development	Relative Combat Power Analysis (RCPA) / 2	FM 101-5	Simulation can calculate and display firepower and protection weighted force structures analysis for friendly and enemy forces based on the friendly and enemy task organization displayed at the time..	GO/NO-GO
	Line of Sight Tool / 4	OneSAF ORD	User can display individual entity or unit fields of fire over elevation and through foliage. Range fan depiction for each weapon/unit type. User can easily change entity location during COA setup or simulation.	GO/NO-GO
	Tasking / 2	AUTL (DA PAM 11-XX)	User can task entities IAW Sections 1 through 3 of Appendix D, of the AUTL. 1 = cannot task, 5 = includes all. 2-4 based on a subjective scale to be determined later.	*1 through 5

CRITERIA FOR SIMULATION DECISION SUPPORT IN THE MDMP

Category	Sub-Category / Question	Reference	Metric	Measure
3. COA Development (CONTINUED)	Tasking / 2	FM 100-5 / FM 3-0	User can assign entities 1 of 5 forms of manuever (envelopment, turning movement, penetration, infiltration, or frontal attack) or 2 patterns of defense (mobile or area) (defend in sector or defend in battle position) or one of 13 stability and support operations / OOTW (see FM 3-0) or other tasks in the AUTL as specified above.	GO/NO-GO
		FM 100-5 / FM 3-0	to be achieved. User can change unit tasks by phase / time of the operation IAW the user developed synchronization matrix.	GO/NO-GO
		ARTEP 7-30-MTP	User can allocate SOPs to units, unit types, or entity types. User can establish global basic Rules of Engagement (ROE) for forces. User can copy routes, orders, SOP's and other Graphical Control Measures to entities.	GO/NO-GO
		ARTEP 7-30-MTP	User can associate risk with an asset by subjectively assigning criticality, vulnerability, recuperability, and threat.	GO/NO-GO
		FM 101-5	User can designate entities as Main Effort (ME) and Supporting Efforts (SE). Implications for this assignment include priority of support.	GO/NO-GO
		ARTEP 7-30-MTP	User can specify the method of employment for lift and attack aviation assets.	GO/NO-GO
		FM 101-5	User can assign headquarters to units, graphic control measures, and create an optional legend.	GO/NO-GO

CRITERIA FOR SIMULATION DECISION SUPPORT IN THE MDMP

Category	Sub-Category / Question	Reference	Metric	Measure
3. COA Development (CONTINUED)	Tasking / 2	FM 101-5	User can assign Purpose, Priority (effort and support), Allocation and Restrictions to capabilities including Engineer Support, Artillery, CAS, ADA and other CS and CSS assets.	GO/NO-GO
		ARTEP 7-30-MTP	Simulation models Air Defense Artillery operations using weapons range fans, elevation, incidental coverage, terrain, graphics, and entity behaviors (including passive air defense, weapon control status, and warning status). Simulation can depict radar coverage in the area of Interest.	GO/NO-GO
	Must include personnel system activities " " civil affairs " " " communication network considerations " " maintenance activities.	ARTEP 7-30-MTP	Simulation models Casualty Evacuation (CASEVAC) operations and resupply with verified models. Also allows bookkeeping of supply classes I, III, IV and V beginning with doctrinal levels or user input. Allows creation of CSS overlay and all other required overlays.	GO/NO-GO
	" " all staff input (non-graphical) and allow for ch input during Dev. & Anal.	ARTEP 7-30-MTP, FM 6-20-10	Simulation accurately models targeting (of entity types) through allocation of the essential fire support tasks including the objective, formation, and function for each target, with its purpose, method, and effects. Also allows assignment of trigger points for artillery targets. User can associate trigger points with decision points, NAI's, or Targeted Areas of Interest (TAI's). User can designate entities as target observers.	GO/NO-GO

CRITERIA FOR SIMULATION DECISION SUPPORT IN THE MDMP

Category	Sub-Category / Question	Reference	Metric	Measure
4. COA Analysis (CONTINUED)	War-gaming / 2	FM 101-5	Simulation allows unlimited user-defined branch and sequel analysis including contingencies, reserve operations, and other decision dependent situations. User can specify abort criteria for units and tasks.	GO/NO-GO
	Identify and assess risk in deep, close rear operations or in one of the types/forms of SASO. State gaps and spt gaps.		Simulation uses verified movement and attrition models for direct and indirect (and EW) weapons including fratricide for each entity type. Simulation adequately models all current munition types and their effects. Also allows addition of munition types.	GO/NO-GO
		ARTEP 7-30-MTP	Simulation accurately models Mobility (SOSR), Countermobility (effects), and Survivability operations and fortifications using dynamic terrain, graphics, and entity behaviors. Simulation models signals used for communication such as star clusters.	GO/NO-GO
		FM 101-5	Simulation allows war-gaming by belt, box, and avenue methods	GO/NO-GO
		ARTEP 7-30-MTP	Simulation facilitates creation of the Decision Support Template (DST), Target Synchronization Matrix, Fire Support Execution Matrix (FSEM), Target List Worksheet, and Execution Matrix and other decision support tools.	GO/NO-GO

CRITERIA FOR SIMULATION DECISION SUPPORT IN THE MDMP

Category	Sub-Category / Question	Reference	Metric	Measure
10. Entity Behaviors (CONTINUED)		OneSAF ORD	CGF entities experience behavioral degradation from the effects of terrain, weather, and operations.	GO/NO-GO
		OneSAF ORD	Entities behave appropriately on all types of terrain, trafficability, vegetation, and features.	GO/NO-GO
11. Recording	4	OneSAF ORD	Simulation allows saving of multiple COA war-game iterations for each mission.	GO/NO-GO
	Logging Capability / 4	OneSAF ORD	Simulation can record and store COA run data including time, entity location, action, and results in a user-friendly database.	GO/NO-GO
11. Recording (CONTINUED)	Logging Capability / 4		Simulation records/estimates COA personnel and equipment losses with supply status usage.	GO/NO-GO
12. Decision Support	Not addressed in this research			

Reminders throughout of important information to pass higher, lower, adjacent (warning orders, requests for clarification, requests for effects or materiel spt, suggestions for graphics changes, etc.).

Reminders throughout of time remaining to produce order (1/3-2/3 rule, 1/5-4/5 rule, or time limit set by unit commander).

Alerts if plan (overlay) conflicts with a stored overlay.

References generally good, however best references (actually used daily during tactical planning) often not ARs, DA-PAMs, or FMs. Gradually, during development of this tool, must research lesser known references.

Part 7: Mr. Schow

1. Do the 12 categories in the attached criteria address all aspects of a simulation supporting the current MDMP process at the tactical level? YES / NO

If NO, why not?

No, probably does not cover everything. May be sufficient for current MDMP. Current MDMP may not be sufficient

2. In the Mission Receipt category (1):

a. Do the sub-categories sufficiently address category attributes? YES / NO

If NO, why not?

Yes, If you assume that this will be conducted in garrison

b. Are all necessary references included? YES / (NO)

Should any references be added, changed, or deleted?

Probably not possible to define "all" and sufficient depends on the particular case

c. Do the measures and associated metrics provide a realistic evaluation tool for a simulation to support the sub-category? YES / (NO)

If not, how should they be changed?

They can form an important basis. How they will be used is important as well

d. Could the phrasing or terminology be changed to improve the quality of the category? YES / NO If YES, make changes directly to the category.

yes. Need to address how well they do it

1

3. In the Mission Analysis category (2):

a. Do the sub-categories sufficiently address category attributes? YES / NO

If NO, why not?

No the categories are good, but they address whether the system does something. Need complimentary ~~how well~~ How well does it do it?

b. Are all necessary references included? YES / NO

Should any references be added, changed, or deleted?

probably the most important are represented

c. Do the measures and associated metrics provide a realistic evaluation tool for a simulation to support the sub-category? YES / NO

If not, how should they be changed?

Need to address how well they work

d. Could the phrasing or terminology be changed to improve the quality of the category? YES / NO If YES, make changes directly to the category.

See above

4. In the COA Development category (3):

a. Do the sub-categories sufficiently address category attributes? YES / NO

If NO, why not?

FN General

COA Development, Analysis and Selection should be one step with the brief being the output of the prior 3 steps

All ~~questions~~ answers on categories following are the same

The metrics form a good basis, but may not be either sufficient or complete as stated

APPENDIX I, UPDATED FRAMEWORK

Category	Sub-Category/Question	Reference	Metric	Measure
1. Mission Receipt	Incorporates Higher Unit **Mission** / 2	FM 101-5, FM 101-5-1, FBCB2 UFD	Includes all FM 101-5-1 symbols and graphics.	**0-100%**
		FM 101-5	**Incorporates higher unit OPORD including text-based products and commander's intent.**	**GO/NO-GO**
	Entity types / 2		Simulation Realistically models all major U.S. and threat equipment entity types and their capabilities. Including terrorist, guerrilla, and conventional threat types. Capable of introducing new types of entities.	**0-100%**
2. Mission Analysis	Represents the Modified Combined Obstacle Overlay (MCOO) / 1	FM 101-5, FM 34-130, FM 7-30, FM 21-26	Simulation Area of Operation (AO) scalable from 1 km2 to a minimum of 9x25 km. Area of Interest (AI) display capability.	GO/NO-GO
		FM 21-26	Simulation can represent 10 Terrain features: Cut, Fill, Hill, Saddle, Ridge, Valley, Spur, Draw, Cliff, Depression using accepted methods in FM 21-26.	**0-100%**
		FM 21-26, FM 5-33	Simulation models all vegetation types of Table 3-4, FM 5-33. Can represent all natural terrain surface configuration, soil features, water features, and obstacles IAW FM 5-33.	**0-100%**
		FM 21-26	Simulation is Military Grid Reference System (MGRS) compatible.	GO/NO-GO
		FBCB2 UFD	Simulation is DED, DTED, **and VPF terrain format** compatible.	GO/NO-GO
		FM 90-10-1, OneSAF ORD, FM 5-33	Simulation uses verified models of urban and dynamic terrain including all man-made object types of Chapter 2, FM 5-33 and all obstacles in FM 101-5-1. **This includes missing bridges, craters, flooding, etc.**	**0-100%**
		ARTEP 7-30-MTP, FM 5-33, FM 34-130	Simulation represents all characteristics of the MCOO IAW "Conduct IPB" task and FM 34-130 by incorporating them from higher product or through user creation.	**0-100%**
	Includes terrain sketch and COA sketch / modification tool / 1	FM 101-5	User can create / add / draw all above criteria, if necessary.	GO/NO-GO
	NBC / Weather analysis and modeling capabilities / 4	FM 34-130, FM 34-81-1, FM 3-6, FM 101-5	Simulation incorporates verified models of effects of all NBC agents, smoke, and weather types.	**0-100%**
	Graphic overlay creation tool and display methods capabilities / 3	FM 101-5, FBCB2 UFD	Simulation can distinguish /display from 0-10 overlays and can have at least 5 COAs open simulaneously. User can scale the display as desired. User can designate the Decisive Point (DP) and key terrain for the operation.	GO/NO-GO
		FM 34-130, ARTEP 7-30-MTP	User can create / display Enemy Event Templates, MCOO, SITTEMPs, doctrinal template, and event matrix. Simulation enables easy addition or deletion of graphical objects to any overlay.	GO/NO-GO
	Displays forces available (friendly and enemy) / 2	FM 101-5	Simulation allows loading of saved or doctrinal task organization. Allows changes to task org including support relationships.	GO/NO-GO
	Displays current situation / 2	ARTEP 7-30-MTP, FM 71-1	Simulation allows user to indicate Unit Basic Load (UBL), Controlled Supply Rates (CSRs) for supply classes I, III, IV, and V as a minimum. Also allows user to change entity supply configuration such as Armor Piercing (AP) heavy, fuel pods, rocket heavy for SEAD aircraft, etc.	GO/NO-GO
		ARTEP 7-30-MTP	User can assign Named Areas of Interest (NAI's) or sensors to entities by time, location, and/or type.	GO/NO-GO
		FM 101-5	User can combine or separate units to task from individual to Brigade level (OPFOR division). User can "join" entities to others to conduct mounted or air movement.	**0-100%**

Category	Sub-Category/Question	Reference	Metric	Measure
3. COA Development	**Step 1:** Relative Combat Power Analysis (RCPA) / 2	FM 101-5	Simulation can calculate and display firepower and protection weighted force structures analysis for friendly and enemy forces based on the friendly and enemy task organization displayed at the time.	GO/NO-GO
	Line of Sight Tool / 4	OneSAF ORD	User can display individual entity or unit fields of fire over elevation and through foliage. Range fan depiction for each weapon/unit type. User can easily change entity location during COA setup or simulation.	GO/NO-GO
	Tasking / 2	AUTL (DA PAM 11-XX)	User can task entities IAW Sections 1 through 3 of Appendix D, of the Army Universal Task List.	**0-100%**
	Step 2: Generate Options / 3	FM 100-5 / FM 3-0	User can assign entities 1 of 5 forms of manuever or 2 patterns of defense (with defend in sector or defend in battle position) **or one of** the stabiliity and support operational tasks of FM 3-0.	**0-100%**
		FM 101-5	User can specify degree of success for each task to be achieved. User can change unit tasks by phase / time of the operation IAW the user developed synchronization matrix.	GO/NO-GO
			User can allocate SOPs to units, unit types, or entity types. User can establish global basic Rules of Engagement (ROE) for forces. User can copy routes, orders, SOP's and other Graphical Control Measures to entities.	**0-100%**
		ARTEP 7-30-MTP	User can associate risk with an asset by subjectively assigning criticality, vulnerability, recuperability, and threat. **Simulation enables risk analysis of close, deep, and rear operations.**	**0-100%**
		FM 101-5	User can designate entities as Main Effort (ME) and Supporting Efforts (SE).	GO/NO-GO
		ARTEP 7-30-MTP	User can specify the method of employment for lift and attack aviation assets.	GO/NO-GO
	Step 3: Array Forces / 3	**FM 101-5**	**User can position and re-position entities on map screen as needed throughout COA development and analysis.**	**GO/NO-GO**
	Step 4: Develop Scheme of Maneuver / 3	**FM 101-5**	**User can develop all elements of scheme of manuever listed in FM 101-5 through text, graphic, or entity-based simulation methods.**	**0-100%**
		FM 101-5	**User can position and reposition control measures (graphic symbols of FM 101-5-1) on map as needed.**	**GO/NO-GO**
		FM 101-5	User can assign Purpose, Priority (effort and support), Allocation and Restrictions to capabilities including Engineer Support, Artillery, CAS, ADA and other CS and CSS assets.	**0-100%**
		ARTEP 7-30-MTP	Simulation models Air Defense Artillery operations using weapons range fans, elevation, incidental coverage, terrain, graphics, and entity behaviors (including passive air defense, weapon control status, and warning status). Simulation can depict radar coverage in the area of Interest.	**0-100%**
		ARTEP 7-30-MTP	Simulation models Casualty Evacuation (CASEVAC) operations and resupply with verified models. Also allows bookkeeping of supply classes I, III, IV and V beginning with doctrinal levels or user input. Allows creation of CSS overlay.	**0-100%**

Category	Sub-Category/Question	Reference	Metric	Measure
3. COA Development (Continued)		ARTEP 7-30-MTP, FM 6-20-10	Simulation accurately models targeting (of entity types) through allocation of the essential fire support tasks including the objective, formation, and function for each target, with its purpose, method, and effects. Also allows assignment of trigger points for artillery targets. User can associate trigger points with decision points, NAI's, or Targeted Areas of Interest (TAI's). User can designate entities as target observers.	**0-100%**
		FM 100-5 / FM 3-0	User can issue Priority of fires, Time on Target, engagement criteria, and priority targets for all weapon / entity types. User can designate entity types as High Payoff Targets (HPTs).	**0-100%**
		FM 7-98, FM 71-1	Simulation can model air and ground resupply including service station, tailgate, and emergency resupply. This includes FAARP, LOGPAC, ROM, FLE, and Forward Support Company (FSC) operations, and Blackstar technique as a minimum for classes I, III, IV, and V.	**0-100%**
		ARTEP 7-30-MTP	Simulation accurately models 4 types of breaching operations, assault, in-stride, covert, and deliberate. Simulation accurately models 3 types of route clearance operations, Linear, Combat, and Combined.	**0-100%**
		ARTEP 7-30-MTP	User can create obstacle zones, belts, or groups with obstacle intent graphics that act as dynamic terrain in aggregated simulation. Simulation gives estimate of Class IV and time requirements based on obstacle type and dimensions.	**0-100%**
	Step 5: Assign Headquarters / 3	FM 101-5	User can assign headquarters to units. User can assign graphic control measures to units and create an optional legend.	GO/NO-GO
	Step 6: Prepare COA statement and sketch / 3	**FM 101-5**	**User can create minimum requirements of COA statement / sketch from FM101-5 using text, graphic, or entity based simulation methods.**	**GO/NO-GO**
4. COA Analysis	War-gaming / 2	FM 101-5	Simulation enables Action / Reaction / Counteraction war-gaming.	GO/NO-GO
		FM 101-5	Simulation uses a method for recording the war game **such as sketch-note or synchronization matrix.**	GO/NO-GO
		FM 101-5	Simulation allows unlimited user-defined branch and sequel analysis including contingencies, reserve operations, and other decision dependent situations **User can specify abort criteria for units and tasks. User can develop and analyze multiple COAs or parts of COAs.**	**0-100%**
			Simulation uses verified movement and attrition models for direct and indirect (and EW) weapons including fratricide for each entity type. Simulation adequately models all current munition types and their effects. Also allows addition of munition types.	**0-100%**
		ARTEP 7-30-MTP	Simulation accurately models Mobility (SOSR), Countermobility (effects), and Survivability operations and fortifications using dynamic terrain, graphics, and entity behaviors.	**0-100%**
			Simulation models signals used for communication such as star clusters.	GO/NO-GO
		FM 101-5	Simulation allows war-gaming by belt, box, or avenue of approach method.	GO/NO-GO

Category	Sub-Category/Question	Reference	Metric	Measure
4. COA Analysis (Continued)		ARTEP 7-30-MTP	Simulation facilitates creation of the Decision Support Template (DST), Target Synchronization Matrix, Fire Support Execution Matrix (FSEM), Target List Worksheet, Execution Matrix and other decision support tools.	GO/NO-GO
5. COA Comparison	3	FM 101-5	Simulation provides standard criteria for COA comparison with adequate estimates of criteria such as supply (class I, III, IV, V) consumption, casualties, relative risk, mass, etc for each COA.	**0-100%**
			Simulation records/tracks other criteria as determined by the commander /staff including subjective criteria. Comparison criteria can be changed depending on the situation.	**GO/NO-GO**
6. COA Briefing and Approval	See orders production and briefing			
7. Orders Production and Briefing	Electronic Distribution / 4	FBCB2 UFD	Simulation allows saving and export of all war-game executions.	GO/NO-GO
		FBCB2 UFD	Simulation allows saving, export, and printing (to scale or as user determined) of all overlays, **decision matrices (FSEM, Synch Matrix, DSM, etc.)** and graphics.	**0-100%**
	Briefing / 4	OneSAF ORD	Simulation allows rapid COA replay **for briefing. User can change replay to skip parts during briefing.**	GO/NO-GO
		OneSAF ORD	Simulation allows voice capture **for commander's intent / maneuver audio with COA simulation for electronic distribution.**	GO/NO-GO
	Text-based Products / 3	**FM 101-5**	**Simulation allows user to develop appropriate MDMP text products including OPORD, WARNORD, FRAGO, etc.**	**0-100%**
8. Flexibility	4	OneSAF ORD, Barone & Roberts, Garrabrants &Blais, Surdu	Simulation is real-time and much faster than real time capable. (Time compression of at least 9:1).	GO/NO-GO
		OneSAF ORD, Barone & Roberts, Garrabrants &Blais, Surdu	User can easily execute a COA simulation using any combination of overlays for contingency analysis. Simulation is interruptible and changeable (entity locations and tasks, etc.) while the COA is executing.	**0-100%**
		OneSAF ORD	The simulation can model up to 10 sides / factions including civilians and Non-Governmental Organizations (NGO's).	**0-100%**
			Simulation is executable on as many Operating Systems as determined feasible.	**0-100%**
			Simulation enables quick (< 1 minute) loading of **previously-saved** COAs.	GO/NO-GO
9. Interoperability	Standards	AR 5-11	Simulation is High Level Architecture (HLA) Compliant.	GO/NO-GO
		AR 5-11	Simulation complies with DOD Technical Architecture Framework for Information Management (TAFIM).	GO/NO-GO
		AR 5-11	Simulation is compatible with the Joint Technical Architecture (JTA).	GO/NO-GO
	Run Time modes / 4	OneSAF ORD	Simulation can run in stand-alone, linked, or networked modes	**0-100%**

Category	Sub-Category/Question	Reference	Metric	Measure
10. Entity Behaviors	2	OneSAF ORD	Simulation can fully automate entity behaviors during war-game simulations, including battlefield congestion.	**0-100%**
			Simulation uses a verified model for unit communications.	GO/NO-GO
		OneSAF ORD	CGF entities recognize graphics (All of FM 101-5-1) including boundaries, control and coordination measures, TRPs, NAI's, objectives, and obstacles and behave accordingly at them.	**0-100%**
		OneSAF ORD	CGF entities experience behavioral degradation from the effects of terrain, weather, and operations.	**0-100%**
		OneSAF ORD	Entities behave appropriately on all types of terrain, trafficability, vegetation, and features.	**0-100%**
11. Recording		OneSAF ORD	Simulation allows saving of multiple COA war-game iterations for each mission.	GO/NO-GO
	Logging Capability / 4	OneSAF ORD	Simulation can record and store COA run data including time, entity location, action, and results in a user-friendly database.	**0-100%**
			Simulation records/estimates COA personnel and equipment losses with supply status usage.	GO/NO-GO
12. Decision Support	Not addressed in this research			
13. Collaborative Planning	**Collaborative Planning / 4**	**JMACE experiment, FBCB2 UFD**	**Simulation is Distributed and Interactive with messaging, real time drawing, commander synchronization control, and MDMP timeline capabilities.**	**0-100%**
	Planning / Analysis / 4		**Simulation supports collaborative distributed rehearsals and After Action Reviews. Allows user to conduct post-mortem analysis of plan flaws.**	**0-100%**
	Concurrent planning Warning orders and Fragmentary orders / 4		**User can distribute parts of simulation, text or graphics at any point in the MDMP to facilitate concurrent planning with subordinates**	**GO/NO-GO**
14. Commander's Guidance	**3**	**FM 101-5**	**Simulation enables staff recording and checking of commander's guidance including CCIR, commander's intent, and guidance through text-based, graphic, or simulation-based functions.**	**0-100%**

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